Supplemental Soil Investigation Work Plan

First Avenue Properties
New York, New York

Waterside Generating Station
708 Office Building
Kips Bay Fuel Terminal
Parking Lot

Prepared by

TRC Environmental Corporation
1200 Wall Street West
Suite 200
Lyndhurst, New Jersey 07071

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APPENDICES

1.0 INTRODUCTION

TRC Environmental Corporation (TRC) developed this Supplemental Soil Investigation Work Plan (Work Plan) for the First Avenue Properties site (Site).[1] The Site lies between First Avenue and the FDR Drive, from East 35th to East 36th Street and from East 38th Street to East 41st Street, New York, New York, and includes the following locations, which are shown on Figure 1:

- Waterside No. 1 and No. 2 Generating Units and 708 First Avenue Office Building
- Kips Bay Fuel Terminal and Transfer Facilities
- 39th Street Parking Lot

The Waterside No. 1 and No. 2 Generation Units and 708 Office Building are located between First Avenue and the FDR Drive, between East 38th and 41st Streets. The Kips Bay Fuel Oil Terminal is located at 616 First Avenue between First Avenue and the FDR Drive, and between East 35th and East 36th Streets. The Parking Lot is located at 685 First Avenue, between East 39th and 40th Streets.

Seventy-seven (77) test borings will be advanced as part of the Supplemental Soil Investigation sampling program as follows:

- The Con Edison Waterside Units No. 1 and No. 2 and 708 First Avenue - 30 borings
- The Kips Bay Fuel Terminal - 29 borings
- The Parking Lot - 18 borings

These borings are spread over the Site and range from relatively shallow borings that extend several feet into bedrock to deep borings that continue for up to 50 feet or more before reaching bedrock. The locations and depths of the borings have been selected to fulfill the program objectives.

Existing structures on site include the Waterside No. 1 and No. 2 Generating Stations and the 708 First Avenue Facility. The Waterside No. 1 and No. 2 Generating Stations also include the Switch House, the Club House, and the Tie Station/Frequency Changer House located on the south half of the block between 40th Street and 41st Street. The 708 First Avenue Facility includes the alley and the buildings on the north half of the block.

Existing structures on the Kips Bay Fuel Terminal site include the Fuel Oil Pump House (containing a 255,000-gallon underground storage tank), associated pump islands, switchgear room/guard Station building, two oil-filled L&P transformers and one dry-type transformer, foam tank building, and a parking lot (it previously contained the site of a former steam generation plant).

The Parking Lot on 39th Street consists of a paved parking area.

Available information including historic foundation drawings and the previous site investigation reports has been reviewed to identify boring and sampling locations, subsurface obstructions, and

[1] TRC modified and amended the Work Plan initially prepared by Langan Engineering, October 2000.

environmental data gaps that may need to be addressed at each boring location. Wherever possible, boring locations have been positioned near previous borings, the previous boring location aiding utility clearance. The exact locations of the previous borings cannot be used due to potential disturbance caused by the original borings.

1.1 Objectives

The principal subsurface geotechnical program objective includes the following:

- Identify the quality and elevations of the underlying bedrock

The geotechnical program also includes a number of concomitant environmental objectives:

- Supplement the existing environmental data set for areas with limited environmental information, prior to preparation of the Voluntary Cleanup Work Plan for investigation/remediation

- Collect supplemental physical and analytical data to further characterize selected site areas

- Collect information to guide waste disposal and material handling during site investigation and remediation activities

- Augment the stratigraphic information and environmental conditions in rock, soil, fill, and other media that may impact investigation/remediation

- Determine potential environmental hazards that will need to be addressed during investigation/remediation

Proposed boring locations are presented in Figures 2, 3, and 4.

1.2 Sequencing and Schedule

Two (2) sets of drilling equipment and crews will operate concurrently at the same property location during the investigation. TRC will have two field geologists/engineers (one a Langan Engineering representative) overseeing the drilling crews and logging the borings. TRC envisions the following drilling sequence:

1. Kips Bay Terminal
2. 39th Street Parking Lot
3. Waterside and 708 First Avenue

In general, outdoor locations will be completed first. At Waterside, interior work will begin at Waterside No. 1, then move to Waterside No. 2, and finally to 708 First Avenue. Borings will begin in the eastern parts of the buildings and move west. The outdoor borings will start along First Avenue, followed by the borings on 39th Street and east of Waterside No. 1, 40th Street and the UST area, and then proceed to alley between 708 First Avenue and the Switch House and Tie Station. Indoor sampling activities will begin in the eastern portion of the Waterside No. 1 basement, with two operating crews utilizing electric drilling equipment (requires 220 volts, 50 amps, three phase) to complete the two (2) basement borings. Alternatively, diesel-powered drill rigs may be used to obtain sufficient down pressure and torque. If diesel units are used, the exhaust will be vented to the outside. Drilling will then move to the Waterside No. 2 facility, beginning in the eastern portion of the basement and moving west.

Borings in locations where other access restrictions exist, such as size of the work area, and height of the ceiling, will be performed last. Boring locations, alternate drilling locations, or changes in schedule may be required depending of the availability of drilling equipment, drilling progress, and/or any Con Edison access restrictions. The schedule and location for implementation of these field activities will be arranged to minimize the impact on on-going Con Edison operations while striving for consistent progress that will maintain schedule. All outdoor borings will be advanced using a truck-mounted drill rig. The proposed work schedule is reviewed below.

In terms of schedule, of the 77 borings, TRC estimates that 71 of the borings each require 1 ½ days to complete, while six borings will take three days each to complete. This yields the following estimated schedule assuming that two drill rigs work simultaneously (all days are regular working days):

Seventy-One 1 ½-Day Borings		107 Days
Six Three-Day Borings		18 Days
Set Up Decontamination and Demobilization		7 Days
Waste Management		7 Days
Unforeseen Delays		7 Days
	Total	146 Days
	With 2 rigs	73 Days

Estimated Duration: Three to 4 months. Refer to Appendix A for detailed schedule.

1.3 Site Reconnaissance

Following a meeting between Con Edison, TRC, Plaza Construction, and Langan Engineering on January 11, 2001, representatives from each organization surveyed the proposed boring locations for access and logistical planning. Con Edison's Construction Management Unit approved all general drilling areas and preliminarily approved all boring locations at Waterside No. 1 and 2 and 708 First Avenue, which were marked by TRC and Plaza Construction at the time. Final approval will occur after consultation between TRC, Con Edison's Construction Management Unit, and the utility clearance crew, NAEVA Geophysics, Inc.

A second meeting occurred on January 14, 2001 for the purpose of showing the driller, Warren George, the site and to layout the boring locations at the 39th Parking Lot and Kips Bay Terminal. TRC and Plaza Construction marked all boring locations.

Because the boring locations encompass a variety of conditions (inside, outside, shallow to rock, deep to rock) in different locations, several drilling methods may be required to obtain the geotechnical and environmental information. TRC anticipates that a combination of drilling methods may be needed at a given location, thus the selection of drilling method needs to remain open to accommodate conditions. In general, however, TRC anticipates that three drilling methods and two coring methods will be used. These include hollow stem auger, drive-and-wash (casing with potable water), NX rock coring, oriented core barrel coring, and mud rotary (and possibly air rotary). Waste minimization methods such as hollow stem augers, drive-and-wash, air rotary, and NX rock coring will be preferred. The driller will be prepared to change methods as needed to insure continuous drilling.

1.4 Areas of Environmental Concern

Previous site investigation reports were reviewed to strategically locate the borings in the vicinity of the identified areas of environmental concern. Types of contaminants that might be encountered at different boring locations are listed in Section 4.0 of this Work Plan.

2.0 UNDERGOUND UTILITY CLEARANCE PROCEDURE

Due to the complexity of underground utilities at the Site, TRC will coordinate with Con Edison Construction Management personnel to clear sampling locations. TRC will employ the following utility clearance procedure for all locations inside the Con Edison property:

1. Con Edison will supply drawings indicating the type and extent of underground utilities on the respective properties. M-scope (electronic) surveys may not be reliable in locating utilities inside the buildings due to the large electrical generating equipment. Consequently, inside the buildings utility clearance will be based on available drawings, the locations of manhole covers, and information from Con Edison personnel knowledgeable about the site and its equipment.

2. The selected driller, Warren George, will notify the NYC One Call Center at (800) 272-4480, in accordance with Code 753, a minimum of five (5) working days prior to any drilling on streets and sidewalks.

3. In consultation with Con Edison, an independent utility markout contractor, NAEVA Geophysics, will spot clear all boring locations for utilities using additional electronic surveillance equipment and ground penetrating radar

The results from this procedure and the site reconnaissance visits will be used to finalize the proposed boring locations.

Con Edison requires that all locations be hand excavated to minimum depth of five (5) feet to safely avoid any underground utilities or structures. Hand clearance (or alternatively air knife digging) will begin by removing a minimum 3-foot by 3-foot section of the existing concrete or asphalt covering using either a grounded jackhammer equipped with a flat blade, or coring a minimum 10-inch-diameter hole using a portable electric core drill (Refer to Appendix B for Con Edison's procedure for grounding temporary equipment).

All drilling locations will then be excavated by hand, using non-sparking tools, or by using other non-evasive methods (air knife and vacuum truck) to five (5) feet below grade before advancing powered drilling equipment. Depending on conditions and concern for utilities, air knife/vacuum removal may extend the excavation beyond five (5) feet, if warranted.

No personnel will enter the excavation once it is deeper than 4.5 feet. During hand excavation, workers will wear electrical insulating gloves. Final requirements as to the depth of hand excavation will be dictated by Con Edison on case-by-case basis (on properties where Con Edison will be involved). If Con Edison's confidence regarding underground clearance is high, in conjunction with the independent utility contractor's findings, and driller concerns, then drilling may proceed without hand excavation.

At locations where sidewalk drilling over or through vaults is proposed, TRC will have an engineer inspect the locations and verify that the vaults will support the drill rig. Alternatively, inside coring may be used if this is more effective.

3.0 SUBSURFACE INVESTIGATION METHODS

Warren George will mobilize the necessary equipment, manpower, and materials to the site. Mobilization will generally occur one day before drilling begins. Before the drilling program begins, Con Edison Station personnel will brief all drilling and geotechnical staff on evacuation procedures. Morning health and safety briefings will be held at the start of each workday as described in the accompanying Health and Safety Plan.

Drilling methods will vary based on conditions encountered. The method selected for individual locations will be based on consultation between TRC (and Langan) Con Edison, and Warren George (given that conditions allow alternatives). For the sake of safety, the final decision will lie with Con Edison who best understands how drilling might affect the facility.

All intrusive equipment will be sufficiently grounded using clamp connectors in accordance with Con Edison procedures (Appendix B). All painted and unpainted concrete surfaces will be sprayed with water prior to cutting to minimize generation of paint chips or dust. Proposed subsurface investigation techniques are summarized below. The methods proposed for each boring location, and potential obstructions and expected contaminants based on previous site investigations are detailed Section 4.0.

3.1 Work Permits

Work permits are required for all activities conducted within the Con Edison facility property and are held by an authorized employee (Construction Management Representative). Work permits requirements will vary based on activity and the location of the work. Con Edison has the authority to halt work at any time. Alternate work will be planned at all times to minimize down time in the event of work stoppage at a given location. Warren George will secure all necessary permits for openings on streets and sidewalks. Appendix C contains a matrix summarizing the responsibilities assigned to all tasks in the subsurface investigation program.

3.2 Utility Clearance

All boring locations inside the Con Edison property will initially be checked for utilities using the clearance procedures discussed in Section 2.0. Upon clearance, the test pit will be backfilled and compacted to support the drilling equipment.

If the soils excavated from the test pit are visually clean, free of chemical odors, and are free of elevated readings on the photoionization detector (PID), the material may be backfilled. The test pit will be filled with soil to within 2 to 4 inches of the surface. The top 2 to 4 inches will be filled with asphalt cold patch as a temporary surface patch until drilling is completed. Clean soil will be imported if there is insufficient material in the excavation to complete backfilling.

If the material is visually contaminated, emits a chemical odor, or registers elevated PID readings, the soil will be containerized and a steel plate, provided by Warren George, will be placed over the excavation. Clean soil will be imported to backfill the excavation after the borehole is complete.

All hand-excavated materials will be staged on 6-mil plastic sheeting directly from the excavation and will remain on the plastic until the soil is removed or backfilled. Vacuumed soil will be placed directly into 55-gallon drums for visual inspection and to avoid contaminating the vacuum truck.

3.3 Groundwater Control

Warren George will mitigate groundwater seepage using either a down hole packer, a flange-mounted standpipe, or compression caps, depending on conditions. Encountering flowing groundwater will add approximately a half-day to each boring. Seepage will be pumped into 55-gallon drums for transport to a central location at each non-contiguous property for storage and waste characterization. At each basement coring location, a pan will be place around the coring bit that will containerize cooling water and groundwater seepage (if any). In addition, berms will be placed around the coring location and any nearby floor drains to prevent groundwater seepage from discharging from the Site. The berms will be constructed of absorbent material and/or sealant and plastic sheeting weighted down with boards, sand bags, or equivalent.

3.4 Drilling Methods

TRC anticipates that several drilling methods will be required to complete the program. One or more of the following methods may be used at a specific drilling location.

<u>Hollow Stem Auger</u>

Borings will be advanced vertically using 4 ¼-inch outside diameter hollow stem augers. The augers will eliminate the need for drilling fluids, except where they extend significantly below the water table. In this case, to control backwash, which interferes with sample collection, the augers will be equipped with a wooded end plug or center plug. In the event that these devices cannot control backwash, potable water may be introduced into the augers to stabilize pressure and control the backwash. This water will be allowed to dissipate into the boring.

All drill cuttings will be staged on 6-mil plastic sheeting unless stored directly in drums. Drums shall be temporarily stored on-site at locations approved by Con Edison. If the cuttings are visually clean and are not registering any elevated readings on the PID, the material will be backfilled into the borehole, as allowed by NYSDEC protocols. If the material is visually contaminated, emits a chemical odor, or registers elevated PID readings, the soil will be containerized and staged at temporary locations approved by Con Edison for off-site disposal.

Drive-and-Wash/Mud Rotary[2]

Borings will be advanced vertically by driving 4-inch-diameter steel casing with a 300-pound hammer falling freely for 24 inches. The casing will be cleaned with water using a tri-cone roller bit and/or chopping bit. Any drilling fluids used to advance the drill bit will be contained within a steel trough and re-circulated into the drill hole. At the end of each work shift, all fluids will be pumped into 55-gallon drums for on-site storage and subsequent off-site disposal. All drill cuttings will be staged on 6-mil plastic sheeting unless stored directly in drums. Drums shall be temporarily stored on-site at locations approved by Con Edison.

Previous investigations identified various levels of contamination and petroleum in the subsurface. Where petroleum "free product" occurs, it poses a remote possibility of migration. To further reduce this risk, TRC will identify boring locations with the highest potential for contaminant migration. The criteria for increased risk are high petroleum concentrations, shallow depth to bedrock and groundwater, and high residual oil saturation levels (primarily Kips Bay Terminal). For those locations with a high contaminant migration potential, the driller will have casing at hand to control migration. Casing will be employed at the discretion of the field geologist/engineer when conditions warrant.

In the event that conditions warrant casing to control contaminant migration, the driller will advance the casing to one foot into competent bedrock or other intervening confining stratum to block any migration of contamination to other zones. If the casing must extend to bedrock, then a hole four (4) inches wider than the casing will be drilled one (1) foot into competent bedrock, the casing inserted, lifted several inches above the bottom of the rock hole, and the space inside and outside the casing tremied with grout such that it fills to the top of the rock hole. The casing will be driven to the bottom of the rock hole and the grout allowed to cure for 24 hours before drilling resumes.

3.5 Drilling Through Gravel Pockets

[2] Alternatively, air rotary drilling may also be used; the drilling fluid is air.

At some locations, previous investigations encountered loose gravel pockets beneath the floor slabs that made it difficult to stabilizing the borehole. If gravel is encountered and the borehole cannot be advanced, TRC will try one or more of the following procedures:

- Advancing steel or polyvinyl chloride (PVC) casing to seal off the gravel
- Advancing a disposable heavy paper tube to seal off the gravel
- Backfilling the hole with clean cement grout and proceed through the grout-stabilized borehole

These methods should stabilize the gravel and should manage most, if not all, gravel thickness.

3.6 Soil Sampling – Geotechnical

Geotechnical soil samples will be recovered at 5-foot intervals and at every change of soil strata; the first sample will be taken at 2 feet 6 inches below the surface.

All samples will be taken using a standard two-inch diameter split-spoon sampler 24 inches long in accordance with the Standard Penetration Test (SPT) Method (ASTM D-1586). The SPT method consists of recording the number of blows required to advance the split-spoon sampler 12 inches after an initial penetration of 6 inches, using a 140-pound weight falling freely for 30 inches. The blows per foot will be designated by the symbol N and will be shown in the boring logs.

In hard materials requiring over 100 blows per 6 inches, the blows for a smaller amount of penetration may be observed and recorded with a special note of the amount of penetration actually obtained.

Records of all borings will include the following:

- size of casing and the number of blows per foot required to advance the casing (to the depth that casing is used); the weight of hammer and the distance of fall; a description of the sampler; a description of the drill tools and equipment including, where used, the size of diamond bits and type of core barrels
- number of blows required to drive the sampling spoon for each six-inch increment of penetration
- elevation of the ground surface referenced to the Manhattan datum (provided subsequent to drilling by the surveyor, GEOD). Boring locations will also be surveyed using the North American Datum (NAD) 83 and New York State Transverse Mercator coordinate system.
- location and depth of the boring
- elevations at which samples were taken
- elevations at which rock core drilling was started and stopped for each "run"
- elevations of the boundaries of soil strata
- percent recovery for each "run" of rock core drilling and rock quality designation (RQD) for each core run

- description of the soil strata encountered and geological classification of rock drilled (based on visual examination of cores) as per Unified Soil Classification (Table 11-1, New York City Building Code)
- any particular, unusual, or special conditions, such as boulders, cavities, and obstructions
- level of groundwater together with a description of how and when the groundwater level was observed

Abandoned or unsuccessful attempts at borings or rock drilling will be reported.

Soil samples will be examined by the on-site TRC and Langan inspectors for identification purposes and be placed inside 8-ounce glass jars and sealed with a twist lid. The glass jars will be labeled and placed in cardboard boxes for storage and transport to the Converse Consultants East, PC, for geophysical laboratory tests. Three-inch-diameter undisturbed, fixed-piston Shelby tube samples will be obtained for strength and compressibility testing.

The testing program will include the identification tests on significant soil strata and physical properties tests on weak soil strata. These latter tests will include shear tests to obtain measurements of their strength, and consolidation tests to obtain data on their compressibility.

In addition, preliminary testing for corrosivity will be performed to evaluate the potential effects of the on-site materials on underground utilities and foundations.

Soil Testing

- Particle Size Analysis of Soils (ASTM D422) – 25 tests
- Liquid Limit, Plastic Limit, Plasticity Index of Soils (ASTM D4319) – 30 tests
- Unconfined Compressive Strength of Cohesive Soils in Triaxial Compression (ASTM D2850) – 12 tests
- Consolidation Properties of Soils (ASTM D2435) – 6 tests
- Consolidation-Undrained Triaxial Compression Tests on Cohesive Soils (ASTM D4767) – 6 tests
- Corrosion Testing of Soils: pH (ASTM D4972) – 20 tests, Resistivity (ASTM DG57) – 20 tests, Sulphates (D516) and Chlorides (D512) – 12 tests
- Void Ratio – 10 tests
    - Total Unit Weight (ASTM D 1586-92 or 1587-94)
    - Water Content (ASTM D 2216-92)
    - Specific gravity (ASTM D 854-92)

Rock Testing

- Unconfined Compression Strength Tests of Rock (ASTM D2938) – 12 tests
- In-Situ Point Load Strength Tests (ASTM D5731) – 12 tests

3.7 Field Screening & Environmental Sampling

During advancement of the borings, soil samples from the 5-foot geotechnical sampling intervals will be examined and screened with a photoionization detector (PID) for indications of volatile organic compounds (as will the cuttings). The samples will also be examined for other signs of contamination (discoloration, staining, odors, fragments, ash, coal, debris). An exception to this sampling interval is in the sidewalk borings proposed by TRC at the 39th Street Parking Lot and along the sidewalk off the southeast corner of Kips Bay Terminal. In both instances, continuous split spoon samples will be advanced. Based on PID readings, olfactory, visual observations, and the judgment of the field geologist/engineer, 36± selected soil samples will be collected and analyzed for chemical parameters from the split-spoon and/or Shelby tube samplers. Tables 1, 2, and 3 present the borings, depths and analyses proposed for environmental laboratory analysis. As a contingency, TRC also has included seven additional samples for characterization of unexpected conditions. TRC will ship the samples to Accutest Laboratories, Dayton, New Jersey for analysis. Accutest is a New York State Department of Health Certified laboratory.

A Quality Assurance Project Plan is attached in Appendix D.

3.8 Rock Coring

Rock coring will commence after refusal with the split-spoon sampler, and the nature of the refusal determined to be the rock. Rock cores will be obtained using an NX size double-tube core barrel with a diamond drill bit. On three (3) borings per site, an oriented core barrel (NX size) shall be used to measure strike of formation and fractures. Each run of the core barrel will be 5 feet or less depending on the quality of the rock and drilling conditions. The TRC/Langan inspector will examine each rock core for identification purposes, and take measurements of percent recovery, Rock Quality Designation (RQD), fracture size and frequency, and foliation dip. Rock cores will be placed in wooden core boxes for storage and transport to a designated off-site storage area under the auspices of Langan. Cores will be stored until they are no longer useful for geotechnical or environmental purposes. A minimum of 20 feet of rock core will be extracted from each borehole. Refer to Section 3.4, Drilling Methods for procedures to prevent migration of contaminants.

4.0 SOIL/ROCK BORING SAMPLING PROCEDURES

The following describes soil/rock boring and sampling procedures at specific locations. Assumptions as to anticipated thickness of slab and depth to rock have been made based on available historic Site drawings and previous investigations. Utility clearance for all locations will follow the procedures in Section 2.0, Utility Clearance Procedure. The specific drilling methods at each location will be determined as described in Section 3.0, Subsurface Investigation Methods.

4.1 Waterside No. 1 Generating Station

Evaluation of historic drawings and reports from previous investigations indicate that at least one-half of the basement floor slab and foundations for Waterside No. 1 are constructed directly on bedrock. Based on the assumption that the drawings are accurate, the following investigative approach will be taken.

4.1.1 Wat 1 City Water Meter Room and East 38th Street Location

One (1) boring will be drilled near this location in the vaulted area on the sidewalk west of Wat 1City Water Meter Room. The borehole will be advanced from the sidewalk using a gasoline powered truck-mounted drill rig, or from inside the vault using a small, portable drill rig. The concrete slab at the base of the vault will be cored from inside the vault with a portable core drill. Bedrock is expected to lie directly beneath the floor slab. Permits to close off the sidewalk and perform work in this location will be obtained by Warren George prior to the commencement of any drilling operations, if required. Previous site investigations indicate that hand clearing of utilities was required in this area based on Con Edison M-scope survey and review of site plans. Additional details regarding the boring are summarized below.

Boring No.	Total Boring Depth[3]	Thickness of Slab	Expected Contaminants[4]	Type of Drill Rig	Drilling Method		
					Concrete	Soil	Rock Core
WS1-1	17ft (below base of vault)	2 ft	Unknown: Potentially Phenol, PCBs, Benzonic Acid, PAHs	Truck Mounted Drill Rig	Portable electric core drill/jack hammer	Tricone Roller Bit, SPT sampler	NX size double tube oriented cores, diamond drill bit
WS1-9*	30ft (below base of vault)	? on sidewalk above vault	Unknown: Potentially Phenol, PCBs, Benzonic Acid, PAHs	Truck Mounted Drill Rig	Portable electric core drill/jack hammer	Tricone Roller Bit, SPT sampler	NX size double tube oriented cores, diamond drill bit
WS1-10*	30ft (below base of vault)	? on sidewalk above vault	Unknown: Potentially Phenol, PCBs, Benzonic Acid, PAHs	Truck Mounted Drill Rig	Portable electric core drill/jack hammer	Tricone Roller Bit, SPT sampler	NX size double tube core barrel, diamond drill bit
WS1-11*	40ft (below base of vault)	? on sidewalk above vault	Unknown: Potentially Phenol, PCBs, Benzonic Acid, PAHs	Truck Mounted Drill Rig	Portable electric core drill/jack hammer	Tricone Roller Bit, SPT sampler	NX size double tube core barrel, diamond drill bit

* A field decision will be made whether these borings are drilled from the street or inside the vault.

4.1.2 Floor Drain Trenches Waterside No. 1

Previous investigations in this location indicate that the basement floor slab is 3 to 6.5 feet thick and rests almost entirely on bedrock. The concrete floor slab consists of a wedge that thickens to the east as bedrock elevations drop.

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[3] Depths are approximate. Actual boring depths for the entire Supplemental Investigation depend on field conditions. For all geotechnical borings, the final depth will be the bottom of a rock core extending 20 feet through competent bedrock.

[4] Based on previous investigations. May vary considerably in the proposed borings in the Supplemental Investigation due to differences in locations and new drilling areas.

Borings in this location will be drilled using a portable core drill. Hand clearing of utilities was not required in this location during previous site investigations due to confidence in utility location, based on a Con Edison M-Scope survey and a review of existing site plans. Two (2) borings are proposed for this location, details of which are summarized below.

Boring No.	Total Boring Depth	Thickness of Slab	Expected Contaminants	Type of Drill Rig	Drilling Method		
					Concrete	Soil	Rock Core
WS1-2	25 ft	3.5ft	PAHs	Portable Electric	Portable Electric Core drill	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit
WS1-3	25 ft	3 ft	PAHs	Portable Electric	Portable Electric Core drill	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit

4.1.3 Former Gas Turbine Area

The former gas turbine area is located on the southeastern corner of the property. According to historic maps and previous investigations, the north intake tunnel for Waterside No. 1 is located beneath the gas turbine area, and numerous other utilities are also present beneath this location. An approximately ½-foot-thick concrete slab overlies this area, and bedrock is estimated at 45 feet below the ground surface. Utility clearance in this location will be verified by hand clearing a 3-foot by 3-foot opening in the asphalt/concrete, followed by vacuum/hand tools to 5 feet or deeper if required. A truck mounted drill rig will be used in this location. One (1) boring is proposed for this location details of which are summarized below.

Boring No.	Total Boring Depth	Thickness of Slab	Expected Contaminants	Type of Drill Rig	Drilling Method		
					Concrete	Soil	Rock Core
WS1-4	70 ft	6 inches	PAHs	Truck Rig	Portable Electric Core drill/jack hammer	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube oriented cores, diamond drill bit

4.2 Intervening Streets (East 39th and East 40th Streets)

Historic drawings indicate a complex network of utilities running the length of the streets as well as between Waterside Units No. 1 and No. 2. It is anticipated that utility lines occur at significant depths. Utility clearance in this location will be verified by hand clearing a 3-foot by 3-foot opening in the asphalt/concrete, followed by vacuum/hand tools. Due to the possibility of deep utilities, hand clearance was required to a depth of 15 feet in previous investigations. The final depth of hand clearance will be authorized by Con Edison representatives.

Along East 39th Street, approximately 4 inches of asphalt covering overlies the Site and bedrock is approximately 30 to 50 feet below the ground surface. Along East 40th Street, approximately 6.5 feet of concrete potentially overlie the bedrock at some locations. Truck-mounted drill rigs will be used for borings in East 39th and East 40th Streets. Details about the borings are summarized below.

Boring No.	Total Boring Depth	Thickness of Slab	Expected Contaminants	Type of Drill Rig	Drilling Method		
					Concrete	Soil	Rock Core
WS1-5	45 ft	4"asphalt	PAHs, Mercury	Truck Rig	Portable Electric Core drill/Jack hammer	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit
WS1-6	45 ft	4"asphalt	PAHs, Mercury	Truck Rig	Portable Electric Core drill/Jack hammer	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit
WS1-7	45 ft	4"asphalt	PAHs, Mercury	Truck Rig	Portable Electric Core drill/Jack hammer	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit
WS1-8/TWS1-1	70 ft	4"asphalt	PAHs, Mercury	Truck Rig	Portable Electric Core drill/Jack hammer	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit

WS2-4	30 ft	7 ft	PAHs, Mercury	Truck Rig	Portable Electric Core drill/Jack hammer	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit
WS2-5	30 ft	7 ft	PAHs, Mercury	Truck Rig	Portable Electric Core drill/Jack hammer	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit
WS2-6	70 ft	7 ft	PAHs, Mercury	Truck Rig	Portable Electric Core drill/Jack hammer	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit
WS2-7/TWS2-2	70 ft	7 ft	PAHs, Mercury	Truck Rig	Portable Electric Core drill/Jack hammer	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit
WS2-8/TWS2-1	70 ft	7 ft	PAHs, Mercury	Truck Rig	Portable Electric Core drill/Jack hammer	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit

4.3 Waterside No. 2 Generating Station

Evaluation of historic drawings and reports from previous investigations at the Site, indicate that approximately two-thirds of the basement floor slab and foundations for Waterside No. 2 are constructed directly on bedrock. Access to the basement will be made via the ramp midway along the eastern basement wall. All borings are contingent upon Con Edison's clearance of the area of energized cables and their position relative to the W2 tunnels. Based on the assumption that the drawings are accurate, the following investigative approach will be taken.

4.3.1 Floor Drain Trenches Waterside No. 2

According to historic drawings, the eastern one-third of the Waterside No. 2 foundation overlies 10 to 15 feet of unconsolidated material and the remaining two-thirds lies directly on bedrock. The floor slab is made up on approximately 3 to 6.5 feet of concrete, however, previous investigations encountered greater than 15 feet of concrete in some locations. Borings in this location will be drilled using a portable electric drill. Hand clearance of utilities was not required in this area during previous site investigations, based on a Con Edison M-Scope survey and a review of existing site plans. Three (3) borings are proposed for this location, details of which are summarized below.

Boring No.	Total Boring Depth	Thickness of Slab	Expected Contaminants	Type of Drill Rig	Drilling Method		
					Concrete	Soil	Rock Core
WS2-1	45 ft	4.5 feet	PAHs, Arsenic, Mercury	Portable electric	Portable Electric Core drill	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit
WS2-2	20 ft	4.5 feet	PAHs, Arsenic, Mercury	Portable electric	Portable Electric Core drill	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit
WS2-3	45 ft	4 feet	PAHs, Arsenic, Mercury	Portable electric	Portable Electric Core drill	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit

4.3.2 708 First Avenue

The 708 First Avenue site is presently occupied by a service garage under an office building that occupies the north half of the block and three smaller buildings (the Switch House, Club House, and Frequency Changer house that occupy the southern half of the property. A narrow asphalt paved alley (Edison Alley) is located in between the buildings at grade. According to historic drawings and reports from previous investigations, the Queens – Midtown Tunnel is located under the western portion of the 708 First Avenue facility at a depth of approximately 48 ft. One boring, 708-1, is located on the sidewalk on this half of the 708 First Avenue property and has been placed so as to avoid interference with the tunnel. The final location for this boring is subject to the review and approval of Con Edison and the Triborough Bridge and Tunnel

Authority. Sidewalk closure permits for this boring will be obtained by Warren George prior to the start of drilling. Bedrock in this location is expected to lie immediately beneath the concrete sidewalk. A truck-mounted drill rig will be used to advance this boring. Warren George will arrange to have utilities marked Code 753 along the sidewalk. Four borings are located in the paved alley, SH-1, 708-5, FH-1, and 708-6. Utility clearance in this location will be verified by hand clearing 3-foot by 3-foot opening in the asphalt/concrete, followed by excavation by vacuum/hand tools for a minimum of 5 feet. The final depth of hand excavation will be based on Con Edison requirements at this location.

Two borings will be drilled inside the lower level of the service garage on the north side of the block. These borings will be drilled using a portable electric drill rig. Previous investigations indicate that the floor slab in this location ranges in thickness from 1.5 to 3.5 feet. Utility clearance in this location will be verified by hand clearing a 3-foot by 3- foot opening in the asphalt/concrete, followed by excavation by vacuum/hand tools for a minimum of 5 feet. The final depth of hand excavation will be based on Con Edison requirements at this location.

A total of 10 borings are proposed for this location, details of which are summarized below.

Boring No.	Total Boring Depth	Thickness of Slab	Expected Contaminants	Type of Drill Rig	Drilling Method		
					Concrete	Soil	Rock Core
SH-1 (Edison Alley)	45 ft	Asphalt (not known)	PAHs, Mercury, BTEX	Truck Rig	Portable Electric Core drill	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube oriented cores, diamond drill bit
FH-1 (Edison Alley)	45 ft	Asphalt (not known)	PAHs	Truck Rig	Portable Electric Core drill	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit
708-1 (sidewalk)	15 ft	Through sidewalk	Unknown	Truck Rig	Portable Electric Core drill/jack hammer	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit

708-2 (service garage)	20 ft	2.5 ft	PAHs, BTEX	Portable electric	Portable Electric Core drill	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit
708-3 (service garage)	40 ft	13 inches	PAHs, BTEX	Portable electric	Portable Electric Core drill	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit
708-5 (service garage)	40 ft	13 inches	PAHs, BTEX	Portable electric	Portable Electric Core drill	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit
708-6 (service garage)	60 ft	13 inches	PAHs, BTEX	Portable electric	Portable Electric Core drill	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit
708-7	50 ft	unknown	PAHs, BTEX, Mercury	Truck Rig	Portable Electric Core drill	Hollow stem, SPT sampler	NX size double tube core barrel, diamond drill bit
708-8	70 ft	unknown	PAHs, BTEX, Mercury	Truck Rig	Portable Electric Core drill	Hollow stem, SPT sampler	NX size double tube core barrel, diamond drill bit
708-9	70 ft	unknown	PAHs, BTEX, Mercury	Truck Rig	Portable Electric Core drill	Hollow stem, SPT sampler	NX size double tube core barrel, diamond drill bit

4.3.3 Underground Storage Tank Area

The underground storage tank area is located at the southwest corner 708 First Avenue and 40th Street. Borings in this location will be drilled using a truck-mounted drill rig. Utility clearance in this location will be verified by hand clearing a 3-foot by 3-foot opening in the asphalt/concrete, followed by excavation by vacuum/hand tools for a minimum of 5 feet. The final depth of hand excavation will be based on Con Edison requirements at this location. Previous investigations revealed that bedrock in this location was encountered at depths ranging from 37 to 52 feet below ground surface. One (1) boring is proposed for this location, details of which are summarized below.

Boring No.	Total Boring Depth	Thickness of Slab	Expected Contaminants	Type of Drill Rig	Drilling Method		
					Concrete	Soil	Rock Core
708-4	60 ft	Up to 5 feet	PAHs, Mercury, BTEX, Naphthalene, Trimethylbenzene	Truck Rig	Jack Hammer	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit

4.4 The Kips Bay Fuel Oil Terminal

A total of 29 borings are proposed for this location, details of which are summarized below.

Boring No.	Total Boring Depth	Thickness of Slab	Expected Contaminants	Type of Drill Rig	Drilling Method		
					Concrete	Soil	Rock Core
B1 through B28, including TKB borings; includes four in sidewalk along East 35th Street	20 ft to 140 ft	4 "asphalt	BTEX, PAHs	Truck Rig	Portable Electric Core drill/Jack hammer	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit; oriented cores on borings B1, B7, and B27

4.5 The Parking Lot

A total of 18 borings are proposed for this location, details of which are summarized below.

Boring No.	Total Boring Depth	Thickness of Slab	Expected Contaminants	Type of Drill Rig	Drilling Method		
					Concrete	Soil	Rock Core
B1 through B13, plus five borings in sidewalk	10 ft to 70 ft	4 "asphalt	BTEX, Lead	Truck Rig	Portable Electric Core drill/Jack hammer	Tricone Roller and/or Hollow Stem Auger bit, SPT sampler	NX size double tube core barrel, diamond drill bit; oriented cores on borings B1, B6, and B10

5.0 DECONTAMINATION

Equipment decontamination will take place in designated areas only. Since the subsurface investigation program encompasses three non-contiguous locations, at least one dedicated decontamination area will be necessary in each non-contiguous parcel, plus a possible fourth at the 708 Office Building (TRC proposes to use the decontamination locations at Waterside for the 708 Office Building). Proposed locations for decontamination at each property are indicated on Figures 2, 3, and 4.

The drilling contractor will construct a decontamination pad of heavy (6-mil) polyethylene plastic sheeting bolstered on the perimeter with wood, hay bales, or other materials so as to contain all decontamination water. The pad will be large enough to accommodate the drill rig and cleaning personnel and will adequately collect all decontamination fluids; it shall have a sump to collect water inside the pad. Decontamination equipment will include:[5]

- Washtubs (1 wash, 1 rinse)
- Several scrub brushes
- Disposable towels
- Seating to facilitate boot removal
- Decontamination solution (e.g., non-phosphate detergent)
- Duct tape
- Hand soap
- Skin wash water source
- Special rinse solutions for hand sampling tools
- Steam cleaner

The decontamination pads will be covered with boards and plastic sheeting during inclement weather, overnight, holidays, and weekends to prevent accumulation of stormwater. Stormwater that does accumulate in the decontamination pads will be managed as decontamination water.

5.1 Drill Rig and Equipment

Decontamination of all drilling equipment and other materials will be conducted at the designated on-site decontamination area(s). Drummed decontamination fluids will be temporarily staged in the drum storage area(s) for subsequent disposal. The decontamination pad and temporarily drum storage area(s) will be located in the same area(s) on the Site, if feasible.

Equipment and casing will be decontaminated using pressurized hot water or steam. The drill rig shall be steam cleaned and brushed to remove all soil, oil, and residue. No visible soil, oil, or residue adhering to the drilling equipment (augers, rods, casing, etc), tracks/tires, or vehicle body shall remain on the equipment prior to removal from the decontamination pad. This will occur prior to arriving on site and before moving from one non-contiguous investigation area to another. An on-site public water supply source will provide water during fieldwork and decontamination activities.

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[5] Portions of this procedure may need to be done inside or in a field trailer to prevent freezing, frostbite and hypothermia.

Drilling tools and down-hole equipment will also be decontaminated at the designated on-site decontamination location. This equipment will be steam cleaned at the decontamination pad between each borehole. Decontamination of split spoons for a specific boring may be done at a satellite decontamination pad next to the rig. This will consist of heavy plastic sheeting under the washtubs with absorbent pads readily available to control spillage.

5.2 Sampling Equipment

All split-spoon samplers and other sampling equipment for environmental samples of non-aqueous media will be field decontaminated according to following procedure:[6]

- Wash/scrub with a biodegradable degreaser ("Simple Green®") if there is oily residue on equipment surface (this step may be eliminated if no visible material is on equipment)[7]
- Tap water rinse
- Wash and scrub with Alconox and water mixture
- Tap water rinse
- Distilled/deionized water rinse
- Air dry

6.0 WASTE MANAGEMENT

6.1 Disposal of Investigation Derived Waste (IDW)

All IDW (decontamination fluids, plastic, bailers, tubing, and PPE) will be collected, drummed, and moved to a designated drum storage area within each of the First Avenue properties. (Materials approved for on-site placement, drill cuttings, drilling mud, and purge water, are not considered IDW.) All containerized waste, drum number, its source (sampling location), and approximate amount will be noted by TRC in a logbook on a daily basis each time waste is placed in a waste container. TRC will label each drum with the same waste management information as in the TRC logbook. Each drum will be numbered and labeled "Investigation Derived Waste Pending Characterization Analysis."

Drummed waste will be transported daily by the drilling contractor to the appropriate designated storage areas for Waterside, Kips Bay Terminal, the 39th Street Parking Lot, and 708 First Avenue. Solid waste and drilling mud will be stored in Type 1A2 containers, liquid waste in Type 1A1 containers. No fluids will be permitted to enter the floor, yard, sanitary drains or spill onto the ground, unless Con Edison approves on-site placement. Equipment and materials used during field activities will be removed from the Site as expeditiously as practical. Daily and at the conclusion of the fieldwork, a general site cleanup will be performed. All non-contaminated solid waste will be disposed in TRC-supplied trash dumpsters (or other containers) at each property. All residual materials will be consolidated by TRC for future disposal in accordance with applicable federal, state, and local requirements. TRC proposes to stage IDW at the

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[6] Sampling equipment used at borings exclusively at geotechnical sampling may not require decontamination in all cases unless obviously contaminated or pose a risk of contaminating other strata or locations.

[7] If gross petroleum product is on equipment, this step may be preceded with a pesticide grade hexane rinse.

decontamination and drum storage areas proposed on Figures 2, 3, and 4 and approved by Con Edison.

The IDW storage areas will consist of a pad constructed like the decontamination pad described in Section 5.0, Decontamination. Drums may rest on pallets for easy movement.

TRC anticipates that nearly all IDW will be non-hazardous. This estimate is based on the results of previous environmental sampling, review of soil boring logs, and our experience with similar sites. The waste classification samples included in this program will further refine this assumption. The location with the largest potential for generating hazardous waste is the 39th Street Parking Lot, where borings along the southeast corner site may contain residual gasoline. If heavily contaminated soil/material occurs during the Supplemental Soil Investigation, it will be segregated so as to minimize the volume of potentially hazardous waste. TRC considers all waste non-hazardous at this time and will label it as described above until analytical testing proves otherwise.

All waste will be handled and manifested by TRC using TRC's own EPA Waste ID numbers for each of the First Avenue properties.

6.2 Drill Cuttings Collection and Disposal

Soil will be backfilled into boreholes where the drill cuttings are visibly clean, free of petroleum product, sheen, odors, and elevated PID readings, or otherwise pose no threat of contamination, in accordance with NYSDEC protocols and Con Edison protocols at other sites. At locations where the cuttings fail to meet all these conditions, the cuttings will be placed in DOT-approved 55-gallon drums and stored at the on-site drum storage location for disposal.

Note that borehole sections through rock will first be sealed using a cement-bentonite grout that will be tremied into the void. This will be completed before any backfilling with clean soil. No rock core segments shall be backfilled with anything other than tremied cement-bentonite grout.

All clean concrete core and asphalt fragments will be temporarily stockpiled on site and covered with plastic or stored in roll-off dumpster as construction debris. It is assumed that this waste will be disposed as construction debris or recycled, with minimal or no sampling required.

6.3 IDW Sample Analysis

Three primary IDW waste classes generated during the subsurface investigation (drill cuttings/mud, purge water/decontamination fluid, plastic, solids, and PPE) will be characterized for disposal via composite sampling. If Con Edison does not approve on-site placement of drill cuttings and water, it is estimated that approximately 110 drums of IDW could be generated by this investigation. Two composite samples of drill cuttings/mud and one composite sample of water will be obtained for waste characterization. Each sample will be analyzed for total VOC, SVOC, Pesticides, PCBs, and metals; full TCLP, reactivity, ignitability and corrosivity. PPE will not be sampled and will receive the same waste characterization as that assigned to the drill cuttings.

Disposal approval normally requires 5 to 7 days following receipt of characterization data. Wastes will be shipped to EQ, Michigan Disposal Waste Treatment Plant, Belleville, Michigan. Freehold Cartage, Inc., Freehold, New Jersey, will provide transportation. Wastes will be removed from the Site within 7 working days of receipt of analytical results/disposal facility approval.

7.0 SITE RESTORATION

The following presents the proposed backfilling/restoration methods for boreholes:

1. **Boreholes on Unpaved Areas**
   Backfill with clean drill cuttings to grade. Any shortfall will be fulfilled using a cement-bentonite grout. All boreholes through rock, as opposed to overburden, will have the rock core portion first sealed with a cement-bentonite grout that will be tremied into the void.

2. **Boreholes Completed Inside Buildings on Floor Slabs and Sidewalks**
   Backfill with clean drill cuttings to bottom of slab. Any shortfall will be fulfilled using a cement-bentonite grout. Starting from the bottom of the slab or sidewalk, fill the cored void with tremied grouted (voids less than one (1) foot do not need to be tremied). Concrete floor slab/sidewalk boreholes will be finished flush with the surrounding surface with the same material/texture as the surrounding base. All boreholes through rock, as opposed to overburden, will have the rock core portion first sealed with a cement-bentonite grout that will be tremied into the void.

3. **Boreholes in Asphalt**
   Backfill with clean drill cuttings to bottom of asphalt. Any shortfall will be fulfilled using a cement-bentonite grout. Patch the remaining 4 inches with cold patch. All boreholes through rock, as opposed to overburden, will have the rock core portion first sealed with a cement-bentonite grout that will be tremied into the void.

Additional site restoration procedures will be performed according to the direction of Con Edison personnel. All drill cuttings and drilling fluids will be temporarily stored on-site and subsequently managed by the methods described in section 6.0.

8.0 SITE LOGISTICS

8.1 Site Access

TRC will coordinate in advance with Con Edison on project schedule, equipment/vehicle requirements, and work locations to allow adequate time for Con Edison to guarantee clear access to all work locations. Access will be as follows:

- Waterside Properties — through the gate located on First Avenue at East 40th Street
- 708 Office Building Basement — from the First Avenue vehicle entrance

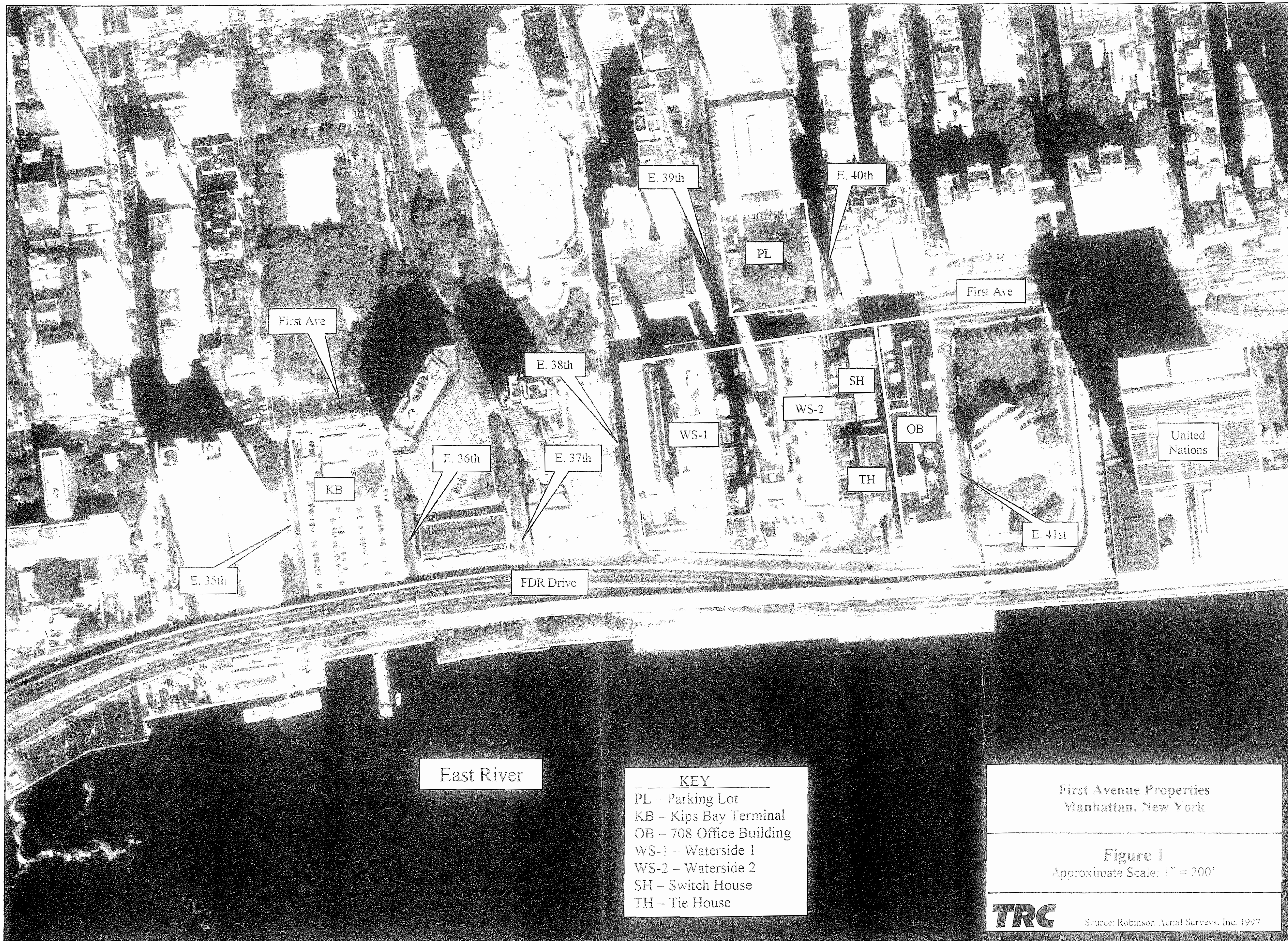
- Parking Lot — from the East 40th Street vehicle entrance
- Eastern portion of Kips Bay Terminal — via the gates installed by TRC at 35th and 36th Streets. Access to the western (active) portion of Kips Bay will be via the active Con Edison vehicle gates.

All personnel must sign in and notify the designated Construction Management representative and report to the designated area. All personnel must sign out when leaving the premises.

One vehicle per contractor will be allowed to park on site. Warren George will be allowed one support truck per drill rig. Since space is at a premium, drill rigs will not be allowed to remain parked and idle on site. Vehicle needs for Warren George, TRC, NAEVA, the surveyor, waste haulers, and Langan will vary over the course of the program. Consequently, TRC will work with Con Edison on a day-to-day basis to resolve parking, space, and vehicle requirements. Individual vehicles not used for support will be parked in TRC's available locations at Kips Bat, Parking Lot, and 708.

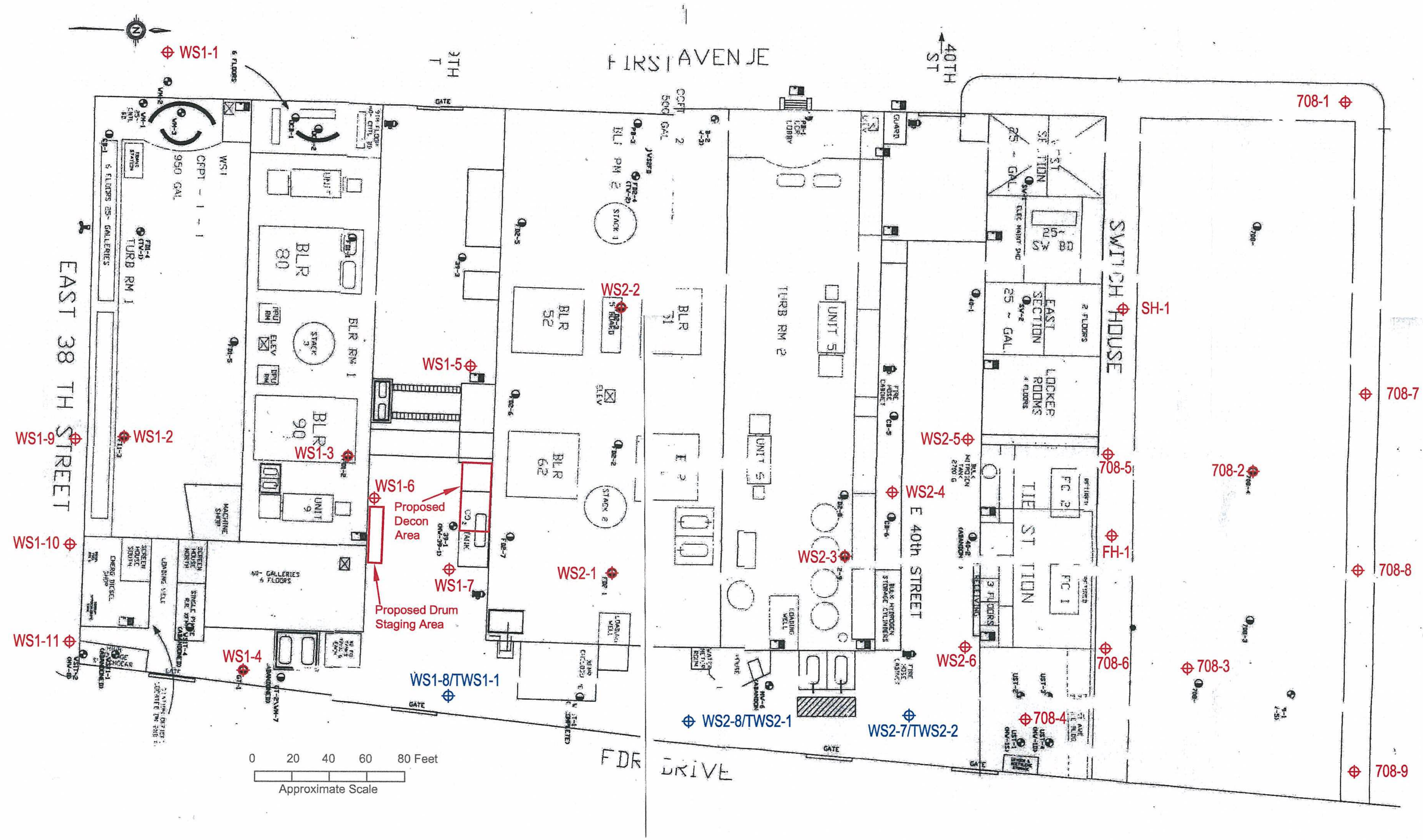
8.2 Site Security

All equipment will be stored on site upon completion of the workday based on approval by the Con Edison representative in a location provided by Con Edison. The Site is guarded 24 hours per day by contract security staff and surveillance cameras. Warren George will be responsible for their equipment.



First Avenue Properties
Manhattan, New York

Figure 1
Approximate Scale: 1" = 200'



Notes:

WS1: Water Side 1
WS2: Water Side 2
FH: Frequency House
SH: Switch House
708: 708 1st Avenue

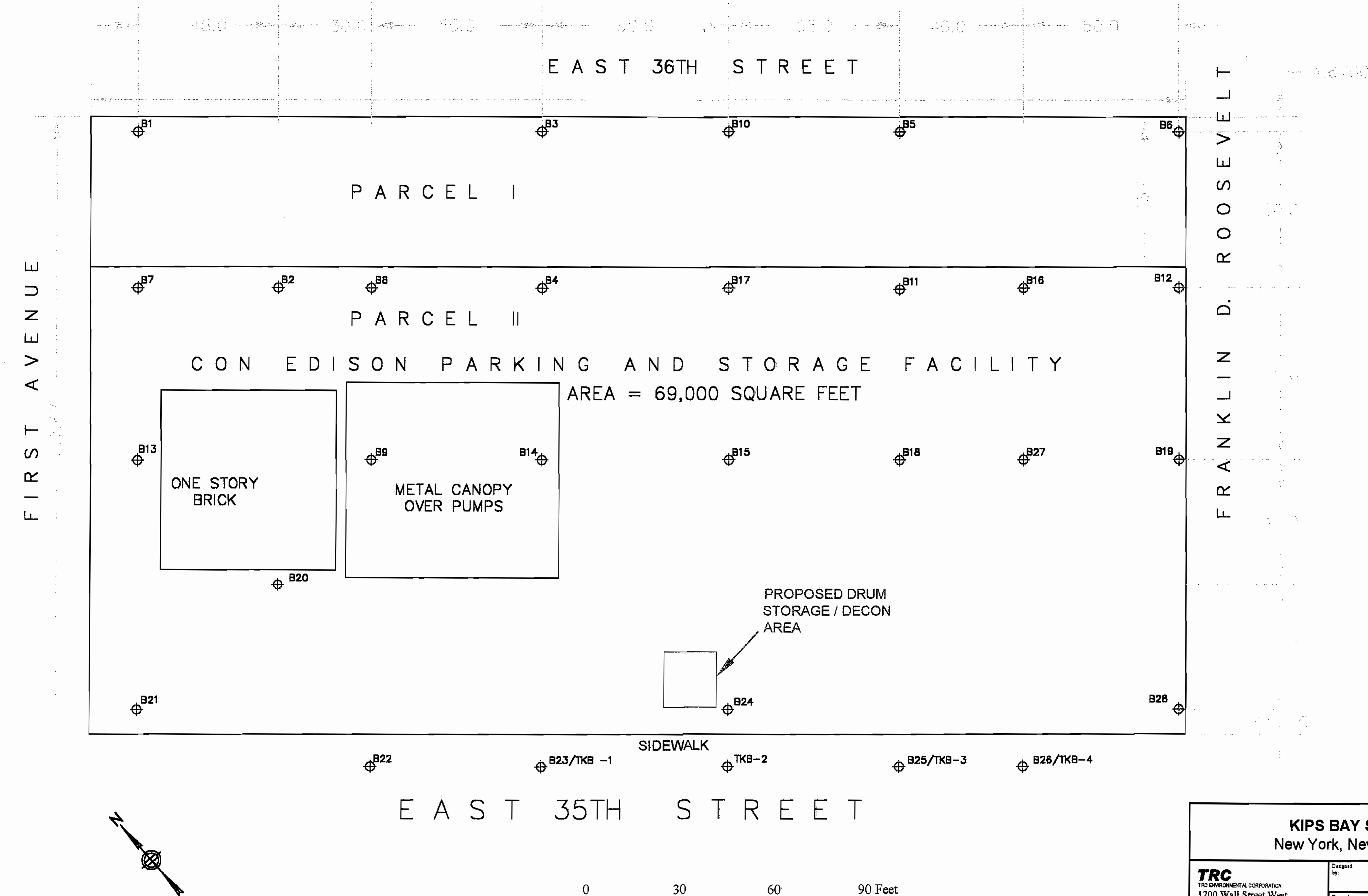
LEGEND

⊕ WS2-1	Proposed Geotechnical Boring Number and Location
⊕ WS2-8/TWS2-1	Proposed Geotechnical / Environmental Boring Number and Location

First Avenue Properties
New York, New York

TRC ENVIRONMENTAL CORPORATION 1200 Wall Street West Lyndhurst, New Jersey 07071	Designed by: SEP	Date: 1-22-01
	Drawn by: BRB	Scale: As Shown
FIGURE 2	File Name: kb_fig2.dwg	Project Number: 28410-OB03-2210T

Drawing Title:
BORING LOCATION PLAN



LEGEND

B22 Proposed Geotechnical Boring Number and Location

B23/TKB-1 Proposed Geotechnical / Environmental Boring Number and Location

KIPS BAY SITE New York, New York		
TRC ENVIRONMENTAL CORPORATION 1200 Wall Street West Lyndhurst, New Jersey 07071	Designed by: SEP	Date: 1-22-01
	Drawn by: BRB	Scale: As Shown
FIGURE 3	File Name: kb_fig3.dwg	Project Number: 28410-KB03-2210T
Drawing Title: **BORING LOCATION PLAN**		

LEGEND

B22 Proposed Geotechnical Boring Number and Location

TPL–1 Proposed Geotechnical / Environmental Boring Number and Location

PARKING LOT SITE New York, New York		
TRC TRC ENVIRONMENTAL CORPORATION 1200 Wall Street West Lyndhurst, New Jersey 07071	Designed by: SEP Drawn by: BRB	Date: 1-22-01 Scale: As Shown
FIGURE 4	File Name: kb_fig4.dwg	Project Number: 28410-PL03-2210T
Drawing Title: **BORING LOCATION PLAN**		

Table 1
Parking Lot - Proposed Environmental Samples
First Avenue Properties - New York, New York

Plan Designed to Meet the Following Objectives:

1. Determine horizontal and vertical limits of gasoline impacts along southeast corner of site in soil and rock
2. Characterize selected portions of previously remediated/backfilled excavation to identify bottom endpoints of contamination; determine site baseline
3. Provide enough data to document clean site inside property line; provide data to guide final remedial effort inside site line and aid soil disposal

Proposed Boring	Environmental Information Required	Sample Depth Interval	Analyses	Rationale	No. of Samples
B1	Upgradient, background conditions, depth to bedrock, character of shallow bedrock (fractures), headspace measurements, soil condition	Field determined based on observations, focus on background conditions	Total Lead[1], BTEX[2], PCBs[3]	Site characterization, baseline conditions	1
B2	Upgradient, background conditions, depth to bedrock, character of shallow bedrock (fractures), headspace measurements, soil condition	Field determined based on observations, focus on background conditions	Total Lead, BTEX, PCBs	Site characterization, baseline conditions	1
B5	Upgradient, background conditions, depth to bedrock, character of shallow bedrock (fractures), headspace measurements, soil condition	Field determined based on observations, focus on background conditions	Total Lead, BTEX, PCBs	Site characterization, baseline conditions	1
B7	Upgradient, background conditions, depth to bedrock, character of shallow bedrock (fractures), headspace measurements, soil condition	Field determined based on observations, focus on background conditions	Total Lead, BTEX, PCBs	Site characterization, baseline conditions	1
B8	Former excavation characterization/delineation	Field determined based on observations, focus on background conditions	Total Lead, VOC[4]	Former excavation characterization/delineation bottom sample	1
B9	Depth to bedrock, character of shallow bedrock (fractures), headspace measurements, core into bedrock to check for spill contaminants, fractures. Assess off-site gasoline impacts.	Weathered bedrock, if feasible	VOC[4]; VOC and Lead TCLP[5] plus RCRA Flammability, TPH GRO[6], grain size, void ratio	Demonstrate all contaminated material removed and/or no remaining hazard in southeast corner	1
B11	Depth to bedrock, character of shallow bedrock (fractures), headspace measurements, core into bedrock to check for spill contaminants, fractures. Bottom verification/delineation sample.	Weathered bedrock, if feasible	VOCs; VOC and Lead TCLP[5]	Former excavation characterization/delineation bottom sample	1
B12	Depth to bedrock, character of shallow bedrock (fractures), headspace measurements, core into bedrock to check for spill contaminants, fractures. Bottom verification/delineation sample.	Weathered bedrock, if feasible	VOCs; VOC and Lead TCLP[5]	Demonstrate all contaminated material removed and/or no remaining hazard in southeast corner; bottom verification sample	1
B13	Depth to bedrock, character of shallow bedrock (fractures), headspace measurements, core into bedrock to check for spill contaminants, fractures. Bottom verification/delineation sample.	Weathered bedrock, if feasible	Total Lead VOC[4]	Demonstrate all contaminated material removed and/or no remaining hazard in southeast corner; bottom verification sample	1

[1] Total lead by SW 846 Method 6000/7000
[2] Benzene, Toluene, Ethylbenzene, Xylenes (BTEX) and MTBE by SW 846 Method 8260
[3] PCBs by Method 8082
[4] Volatile organics (VOCs) and MTBE by SW 846 Method 8260
[5] SW 846 Methods 1311; 8260; 6000/7000; RCRA Flammability
[6] Method 8015B

Table 1 cont.
Parking Lot - Proposed Environmental Samples
First Avenue Properties - New York, New York

Plan Designed to Meet the Following Objectives:

1. Determine horizontal and vertical limits of gasoline impacts along southeast corner of site in soil and rock
2. Characterize selected portions of previously remediated/backfilled excavation to identify bottom endpoints of contamination; determine site baseline
3. Provide enough data to document clean site inside property line; provide data to guide final remedial effort inside site line and aid soil disposal

Proposed Boring	Environmental Information Required	Sample Depth Interval	Analyses	Rationale	No. of Samples
TPL1 Sidewalk boring southeast corner of site	Depth to bedrock, character of shallow bedrock (fractures) and soils, headspace measurements, core into bedrock to check for spill contaminants, fractures, gauge any off-site impacts	Field determined based on observations, but focus on determining limit of gasoline impacts near excavated zone in weathered bedrock ~10 to 12+ft	VOCs; VOC and Lead TCLP[5] plus RCRA Flammability, TPH GRO[6], grain size, void ratio	Demonstrate all contaminated material removed and/or no remaining hazard in off-site portion of southeast corner	1-2
TPL2 Sidewalk boring southeast corner of site	Depth to bedrock, character of shallow bedrock (fractures) and soils, headspace measurements, core into bedrock to check for spill contaminants, fractures, gauge any off-site impacts	Field determined based on observations, but focus on determining limit of gasoline impacts near excavated zone in weathered bedrock ~10 to 12+ft	VOCs; VOC and Lead TCLP[5] plus RCRA Flammability, TPH GRO[6], grain size, void ratio	Demonstrate all contaminated material removed and/or no remaining hazard in off-site portion of southeast corner	1-2
TPL3 Sidewalk boring southeast corner of site	Depth to bedrock, character of shallow bedrock (fractures) and soils, headspace measurements, core into bedrock to check for spill contaminants, fractures, gauge any off-site impacts	Field determined based on observations, but focus on determining limit of gasoline impacts near excavated zone in weathered bedrock ~10 to 12+ft	VOCs; VOC and Lead TCLP[5] plus RCRA Flammability, TPH GRO[6], grain size, void ratio	Demonstrate all contaminated material removed and/or no remaining hazard in off-site portion of southeast corner	1-2
TPL4 Sidewalk boring southeast corner of site	Depth to bedrock, character of shallow bedrock (fractures) and soils, headspace measurements, core into bedrock to check for spill contaminants, fractures, gauge any off-site impacts	Field determined based on observations, but focus on determining limit of gasoline impacts near excavated zone in weathered bedrock ~10 to 12+ft	VOCs; VOC and Lead TCLP[5] plus RCRA Flammability	Demonstrate all contaminated material removed and/or no remaining hazard in off-site portion of southeast corner	1-2
TPL5 Sidewalk boring southeast corner of site	Depth to bedrock, character of shallow bedrock (fractures) and soils, headspace measurements, core into bedrock to check for spill contaminants, fractures, gauge any off-site impacts	Field determined based on observations, but focus on determining limit of gasoline impacts near excavated zone in weathered bedrock ~10 to 12+ft	VOCs; VOC and Lead TCLP[5] plus RCRA Flammability, TPH GRO[6], grain size, void ratio	Demonstrate all contaminated material removed and/or no remaining hazard in off-site portion of southeast corner	1-2

[1] Total lead by SW 846 Method 6000/7000
[2] Benzene, Toluene, Ethylbenzene, Xylenes (BTEX) and MTBE by SW 846 Method 8260
[3] PCBs by Method 8082
[4] Volatile organics (VOCs) and MTBE by SW 846 Method 8260
[5] SW 846 Methods 1311; 8260; 6000/7000; RCRA Flammability
[6] Method 8015B

Table 2
Kips Bay Terminal - Proposed Environmental Samples
First Avenue Properties - New York, New York

Proposed Boring	Environmental Information Required	Sample Depth Interval	Analyses	Rationale	No. of Samples
B1	Depth to bedrock, stratigraphy, water table, till character, subsurface contaminant observations, substructure mounding effects	Field determined based on observations, focus on deep depth or top of rock	Naphthalene and PAHs[1], VOC[2], metals[3]	No information at depth, close to major oil release Look for free product from release	1, if boring >15', at depth or worst visual
B6	Depth to bedrock, stratigraphy, water table, fill character, subsurface contaminant observations, substructure mounding effects	Field determined based on observations, focus on water table, at depth, top of rock Base on stratigraphy, permeable strata	Naphthalene and PAHs[1], BTEX[4], metals[3]	Limited information at this location at depth	1
B7	Depth to bedrock, stratigraphy, water table, fill character, subsurface contaminant observations, substructure mounding effects	Field determined based on observations, focus on deep depth or top of rock	Naphthalene and PAHs[1], VOC[2], metals[3], Full TCLP[5]	No information at depth, close to major oil release Look for free product from release	1, if boring if >15'
B9	Depth to bedrock, stratigraphy, water table, fill character, subsurface contaminant observations, substructure mounding effects	Field determined based on observations, focus on deep depth or top of rock	Naphthalene and PAHs[1], VOC[2], metals[3], Full TCLP[5]	No information at depth, close to major oil release	1
B15	Depth to bedrock, stratigraphy, water table, fill character, subsurface contaminant observations, substructure mounding effects; slab thickness, rebar present, rebar type	Field determined based on observations, focus on water table, at depth, top of rock Base on stratigraphy, permeable strata; sample above and below slab	Naphthalene and PAHs[1], BTEX[4], metals[3]	No information at this location	2, shallow and deep
B18	Depth to bedrock, stratigraphy, water table, fill character, subsurface contaminant observations, substructure mounding effects; slab thickness, rebar present, rebar type	Shallow, 6 to 7 feet, above slab; below slab based on field conditions	Naphthalene and PAHs[1], BTEX[4], metals[3]	Need info on shallow fill.	2, shallow and deep
B19	Depth to bedrock, stratigraphy, water table, fill character, subsurface contaminant observations, substructure mounding effects	Field determined based on observations, focus on water table, at depth, top of rock Base on stratigraphy, permeable strata	Naphthalene and PAHs[1], VOC[2], metals[3], Full TCLP[5]	Limited information at this location at depth	1
B22	Depth to bedrock, stratigraphy, water table, fill character, subsurface contaminant observations, substructure mounding effects	Field determined based on observations, focus on deep depth or top of rock	Naphthalene and PAHs[1], BTEX[4], metals[3]	No information at depth, close to major oil release Look for free product from release	1

[1] SW 846 Method 8270, Polynuclear Aromatic Hydrocarbons (PAHs) per NY Dept. of Env. Cons. STARS List
[2] Volatile Organic Compounds (VOC) SW 846 Method 8260
[3] Priority Pollutant Metals SW 846 Method 6000/7000
[4] Benzene, Toluene, Ethylbenzene, Xylenes (BTEX) by SW 846 Method 8260
[5] SW 846 Methods 1311; 6000/7000; 8260; 8270; RCRA Characteristics

Table 2 cont.
Kips Bay Terminal - Proposed Environmental Samples
First Avenue Properties - New York, New York

Proposed Boring	Environmental Information Required	Sample Depth Interval	Analyses	Rationale	No. of Samples
B25/TKB3	Depth to bedrock, stratigraphy, water table, fill character, subsurface contaminant observations, substructure mounding effects, slab thickness, rebar present, rebar type	Field determined based on observations, focus on water table, at depth, top of rock Base on stratigraphy, permeable strata	Naphthalene and PAHs[1], BTEX[4], metals[3]	Limited information at this location at depth	1
B28	Depth to bedrock, stratigraphy, water table, fill character, subsurface contaminant observations, substructure mounding effects	Field determined based on observations, focus on water table, at depth, top of rock Base on stratigraphy, permeable strata	Naphthalene and PAHs[1], VOC[2], metals[3], Full TCLP[5]	Limited information at this location at depth; focus on deep zone	1
B23/TKB1 Sidewalk Borings along East 35^{th} Street	Extent of contamination beneath sidewalk and estimate of contaminant concentrations, depth to approximately 15 feet	Field determined based on observations, Base on stratigraphy, permeable strata	Naphthalene and PAHs[1], VOC[2], metals[3], Full TCLP[5]	No information available for this area	2 - 3
TKB2 Sidewalk Borings along East 35^{th} Street	Extent of contamination beneath sidewalk and estimate of contaminant concentrations, depth to approximately 15 feet	Field determined based on observations, Base on stratigraphy, permeable strata	Naphthalene and PAHs[1], VOC[2], metals[3], Full TCLP[5]	No information available for this area	2 - 3
B26/TKB4 Sidewalk Borings along East 35^{th} Street	Extent of contamination beneath sidewalk and estimate of contaminant concentrations, depth to approximately 15 feet	Field determined based on observations, Base on stratigraphy, permeable strata	Naphthalene and PAHs[1], VOC[2], metals[3], Full TCLP[5]	No information available for this area	2 - 3

[1] SW 846 Method 8270, Polynuclear Aromatic Hydrocarbons (PAHs) per NY Dept. of Env. Cons. STARS List
[2] Volatile Organic Compounds (VOC) SW 846 Method 8260
[3] Priority Pollutant Metals SW 846 Method 6000/7000
[4] Benzene, Toluene, Ethylbenzene, Xylenes (BTEX) by SW 846 Method 8260
[5] SW 846 Methods 1311; 6000/7000; 8260; 8270; RCRA Characteristics

Table 3

Waterside Units No. 1 & 2, 708 First Avenue - Proposed Environmental Samples

First Avenue Properties - New York, New York

Proposed Boring	Environmental Information Required	Sample Depth Interval	Analyses	Rationale	No. of Samples
708-3	Depth to bedrock, stratigraphy, water table, fill character, subsurface contaminant observations, substructure mounding effects	Field determined based on observations, focus on deep depth or top of rock	Naphthalene and PAHs[1], VOC[2], metals[3]	No information at depth, close to MGP facility and potential pathway Look for MGP contamination	1, if boring >15', at depth or worst visual
WS1-4	Depth to bedrock, stratigraphy, water table, fill character, subsurface contaminant observations, substructure mounding effects	Field determined based on observations, focus on deep depth or top of rock	Naphthalene and PAHs[1], VOC[2], metals[3]	No information at depth, close to potential pathway	1
WS1-8/TWS1-1	Depth to bedrock, stratigraphy, water table, fill character, subsurface contaminant observations, substructure mounding effects	Field determined based on observations, focus on deep depth or top of rock	Naphthalene and PAHs[1], VOC[2], metals[3], Full TCLP[4]	No information at depth, close to MGP facility and potential pathway Look for MGP contamination	1 each, 2 TCLP
WS2-8/TWS2-1	Depth to bedrock, stratigraphy, water table, fill character, subsurface contaminant observations, substructure mounding effects	Field determined based on observations, focus on deep depth or top of rock	Naphthalene and PAHs[1], VOC[2], metals[3], Full TCLP[4]	No information at depth, close to MGP facility and potential pathway Look for MGP contamination	1 each, 2 TCLP
WS2-7/TWS2-2	Depth to bedrock, stratigraphy, water table, fill character, subsurface contaminant observations, substructure mounding effects	Field determined based on observations, focus on deep depth or top of rock	Naphthalene and PAHs[1], VOC[2], metals[3], Full TCLP[4]	No information at depth, close to MGP facility and potential pathway Look for MGP contamination	1 each, 2 TCLP

[1] SW 846 Method 8270, Polynuclear Aromatic Hydrocarbons (PAHs) per NY Dept. of Env. Cons. STARS List
[2] Volatile Organic Compounds (VOC) SW 846 Method 8260
[3] Priority Pollutant Metals SW 846 Method 6000/7000
[4] SW 846 Methods 1311; 6000/7000; 8260; 8270; RCRA Characteristics

Table 4

First Avenue Properties Supplemental Investigation Boring List

Boring No.	Purpose	Location	Obstructions	Site	Remarks
B1	Geotech/Env	Lot		Kips Bay	
B10	Geotech	Lot	Slab	Kips Bay	
B11	Geotech	Lot	Slab	Kips Bay	
B12	Geotech	Lot	Slab	Kips Bay	
B13	Geotech	Lot		Kips Bay	
B14	Geotech	Lot		Kips Bay	
B15	Geotech/Env	Lot	Slab	Kips Bay	
B16	Geotech	Lot	Slab	Kips Bay	
B17	Geotech	Lot	Slab	Kips Bay	
B18	Geotech/Env	Lot	Slab	Kips Bay	
B19	Geotech	Lot	Slab	Kips Bay	
B2	Geotech	Lot		Kips Bay	
B20	Geotech/Env	Lot		Kips Bay	
B21	Geotech	Lot		Kips Bay	
B22	Geotech	Sidewalk		Kips Bay	
B23/TKB1	Geotech/Env	Sidewalk		Kips Bay	
B24	Geotech	Lot	Slab	Kips Bay	
B25/TKB3	Geotech/Env	Sidewalk		Kips Bay	
B26/TKB4	Geotech/Env	Sidewalk		Kips Bay	
B27	Geotech	Lot	Slab	Kips Bay	
B28	Geotech/Env	Lot	Slab	Kips Bay	
B3	Geotech	Lot		Kips Bay	
B4	Geotech	Lot		Kips Bay	
B5	Geotech	Lot	Slab	Kips Bay	
B6	Geotech/Env	Lot	Slab	Kips Bay	
B7	Geotech/Env	Lot		Kips Bay	
B8	Geotech	Lot		Kips Bay	
B9	Geotech/Env	Lot		Kips Bay	
TKB2	Environmental	Sidewalk		Kips Bay	

Table 4 cont.

First Avenue Properties Supplemental Investigation Boring List

Boring No.	Purpose	Location	Obstructions	Site	Remarks
B1	Geotech/Env	Lot		Parking Lot	
B10	Geotech	Lot		Parking Lot	
B11	Geotech/Env	Lot		Parking Lot	
B12	Geotech/Env	Lot		Parking Lot	
B13	Geotech/Env	Lot		Parking Lot	
B2	Geotech/Env	Lot		Parking Lot	
B3	Geotech	Lot		Parking Lot	
B4	Geotech	Lot		Parking Lot	
B5	Geotech/Env	Lot		Parking Lot	
B6	Geotech	Lot		Parking Lot	
B7	Geotech/Env	Lot		Parking Lot	
B8	Geotech/Env	Lot		Parking Lot	
B9	Geotech/Env	Lot		Parking Lot	
TPL1	Environmental	Sidewalk		Parking Lot	
TPL2	Environmental	Sidewalk		Parking Lot	
TPL3	Environmental	Sidewalk		Parking Lot	
TPL4	Environmental	Sidewalk		Parking Lot	
TPL5	Environmental	Sidewalk		Parking Lot	

Table 4 cont.

First Avenue Properties Supplemental Investigation Boring List

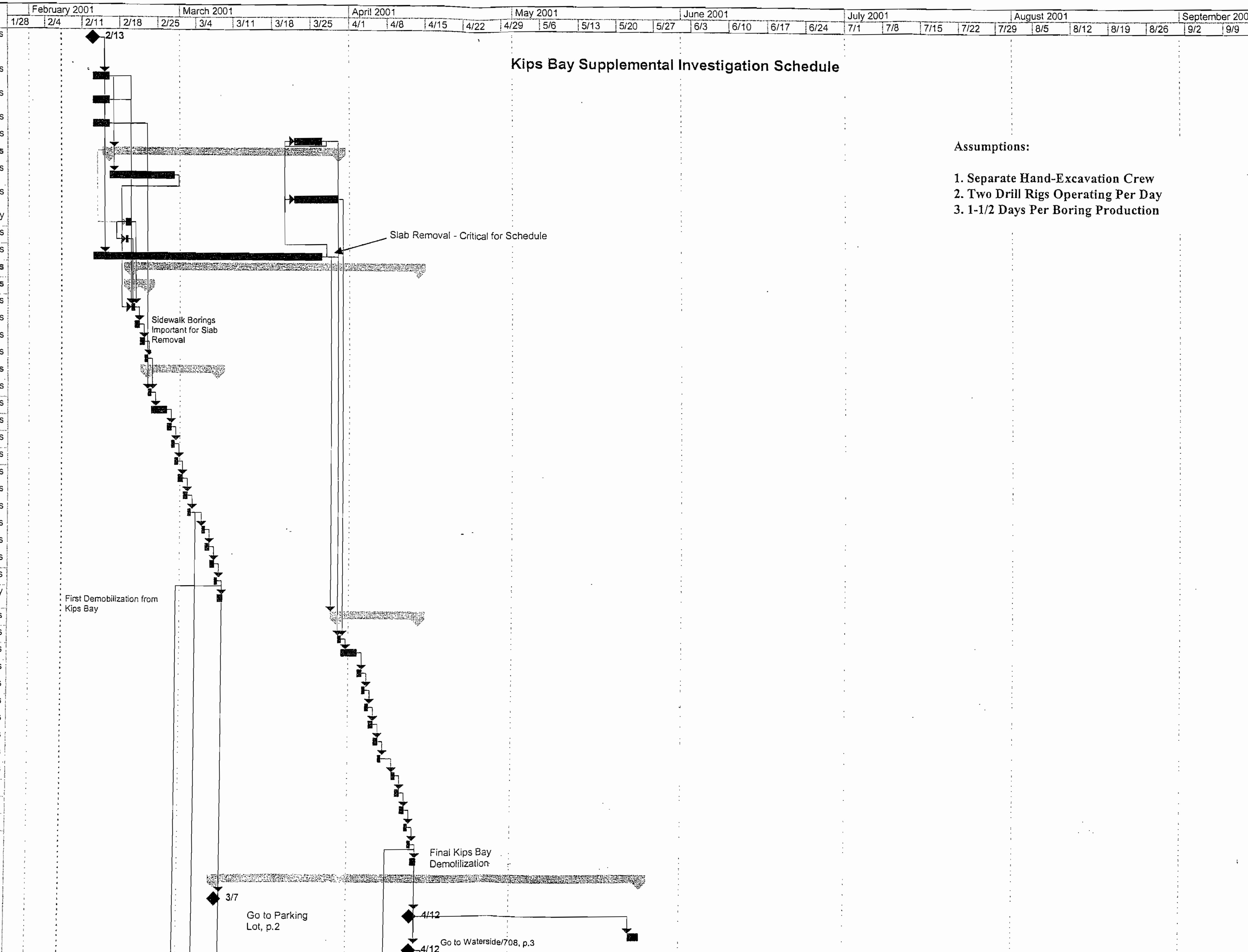
Boring No.	Purpose	Location	Obstructions	Site	Remarks
WS1-1	Geotech	Sidewalk	Vault Below	Waterside 1	Needs Engineer's Prior Vault and Rig Weight Review
WS1-10	Geotech	Sidewalk	Vault Below	Waterside 1	Needs Engineer's Prior Vault and Rig Weight Review
WS1-11	Geotech	Sidewalk	Vault Below	Waterside 1	Needs Engineer's Prior Vault and Rig Weight Review
WS1-2	Geotech	Building	Slab	Waterside 1	
WS1-3	Geotech	Building	Slab	Waterside 1	
WS1-4	Geotech/Env	Lot		Waterside 1	
WS1-5	Geotech	Lot		Waterside 1	
WS1-6	Geotech	Lot		Waterside 1	
WS1-7	Geotech	Lot		Waterside 1	
WS1-8/TWS1-1	Geotech/Env	Lot		Waterside 1	
WS1-9	Geotech	Sidewalk	Vault Below	Waterside 1	Needs Engineer's Prior Vault and Rig Weight Review
WS2-1	Geotech	Building	Slab/Tunnel	Waterside 2	
WS2-2	Geotech	Building	Slab/Tunnel	Waterside 2	
WS2-3	Geotech	Lot	Slab/Tunnel	Waterside 2	
WS2-4	Geotech	Lot		Waterside 2	
WS2-5	Geotech	Lot		Waterside 2	
WS2-6	Geotech	Lot		Waterside 2	
WS2-7/TWS2-2	Geotech/Env	Lot		Waterside 2	
WS2-8/TWS2-1	Geotech/Env	Lot		Waterside 2	
708-1	Geotech	Sidewalk	Vault Below/Tunnel	708 Office Building	Needs Engineer's Prior Review/ Midtown Tunnel ~48 ft
708-2	Geotech	Building	Slab	708 Office Building	
708-3	Geotech/Env	Building	Slab	708 Office Building	
708-4	Geotech	Lot	Tunnel	708 Office Building	
708-5	Geotech	Lot	Tunnel	708 Office Building	
708-6	Geotech	Lot	Tunnel	708 Office Building	
708-7	Geotech	Sidewalk	Tunnel	708 Office Building	Midtown Tunnel ~48 ft
708-8	Geotech	Sidewalk	Tunnel	708 Office Building	Midtown Tunnel ~48 ft
708-9	Geotech	Sidewalk	Tunnel	708 Office Building	Midtown Tunnel ~48 ft
FH-1	Geotech	Lot	Tunnel	708 Office Building	
SH-1	Geotech	Lot	Tunnel	708 Office Building	

Appendix A

Schedule

Kips Bay Supplemental Investigation Schedule

ID	Task Name	Duration
1	**Begin Supplemental Investigation**	0 days
2	Sidewalk Permit Acquisition - Kips Bay	3 days
3	One Call Notification for Sidewalk Drilling	3 days
4	Utility Clearance (Begin)	3 days
5	Utility Clearance (Slab Borings)	3 days
6	**Hand/Vacuum Excavation**	**30 days**
7	Hand/Vacuum Excavation - Sidewalk/Non Slab	8 days
8	Hand/Vacuum Excavation - Slab Borings	6 days
9	Mobilization - Drilling	1 day
10	Work Permits & Rig Inspection	0.2 days
11	Slab Removal	6 wks
12	**Drilling Start - Kips Bay**	**38.75 days**
13	**Sidewalk Borings**	**3 days**
14	B23/TKB1	0.75 days
15	TKB2	0.75 days
16	B25/TKB3	0.75 days
17	B26/TKB4	0.75 days
18	**Non-Slab Borings**	**9 days**
19	B1	0.75 days
20	B2	0.75 days
21	B3	0.75 days
22	B4	0.75 days
23	B7	0.75 days
24	B8	0.75 days
25	B9	0.75 days
26	B13	0.75 days
27	B14	0.75 days
28	B20	0.75 days
29	B21	0.75 days
30	B22	0.75 days
31	Demobilization from Kips Bay - 1	1 day
32	**Slab Borings**	**10.75 days**
33	B5	0.75 days
34	B6	0.75 days
35	B10	0.75 days
36	B11	0.75 days
37	B12	0.75 days
38	B15	0.75 days
39	B16	0.75 days
40	B17	0.75 days
41	B18	0.75 days
42	B19	0.75 days
43	B24	0.75 days
44	B27	0.75 days
45	B28	0.75 days
46	Kips Bay Final Demobilization	1 day
47	**Waste Management**	**55.75 days**
48	IDW Sampling - 1	0 days
49	IDW Sampling - 2	0 days
50	IDW Removal	2 days
51	Complete Kips Bay	0 days

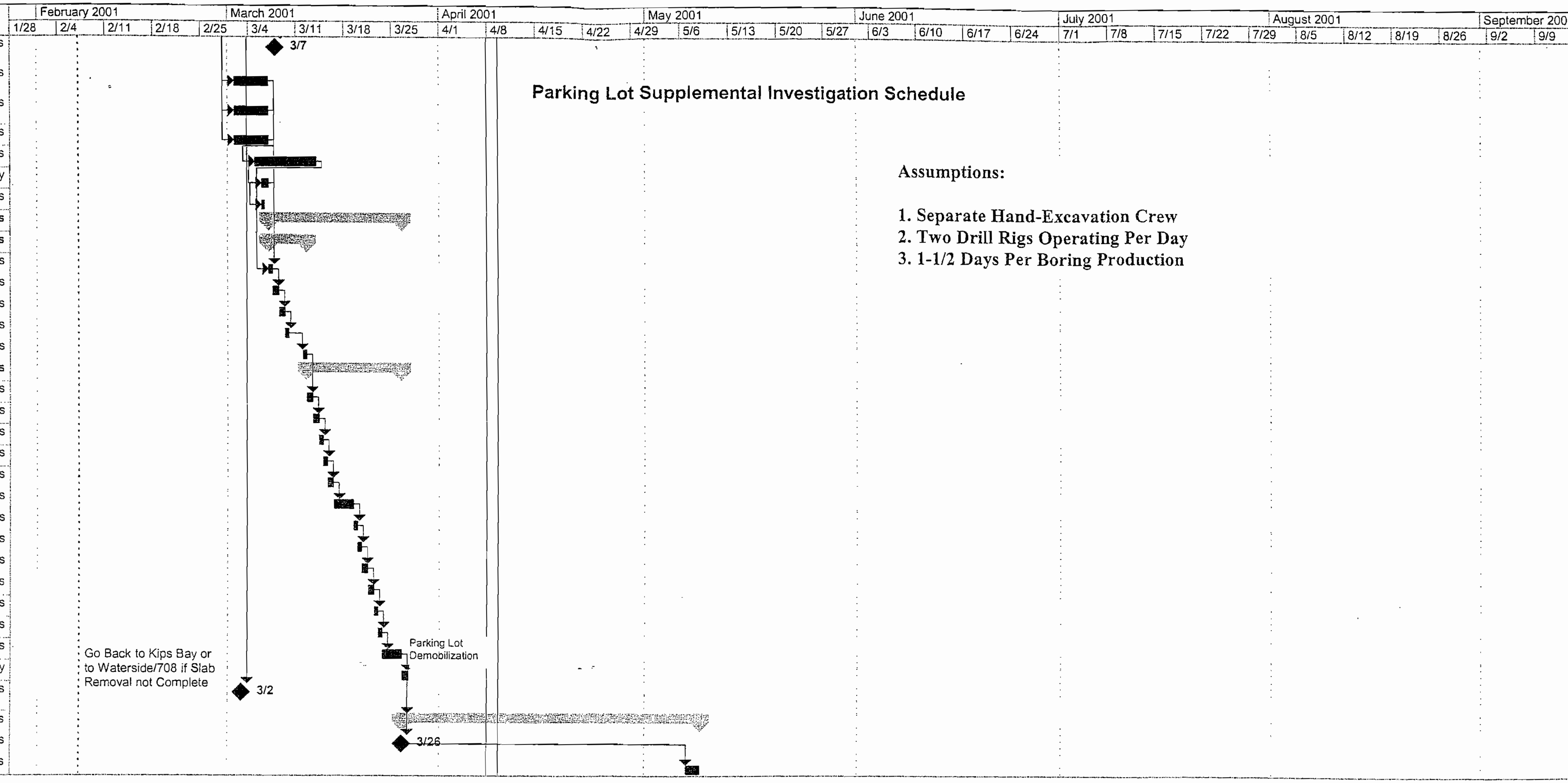


Assumptions:

1. Separate Hand-Excavation Crew
2. Two Drill Rigs Operating Per Day
3. 1-1/2 Days Per Boring Production

Parking Lot Supplemental Investigation Schedule

ID	Task Name	Duration
52	**Drilling Start - Parking Lot**	0 days
53	Sidewalk Permit Acquisition - Parking Lot	3 days
54	One Call Notification for Sidewalk Drilling	3 days
55	Utility Clearance	3 days
56	Hand/Vacuum Excavation	7 days
57	Mobilization	1 day
58	Work Permits & Rig Inspection	0.2 days
59	**Drilling - Parking Lot**	**13.5 days**
60	**Sidewalk Borings**	**3.75 days**
61	TPL1	0.75 days
62	TPL2	0.75 days
63	TPL3	0.75 days
64	TPL4	0.75 days
65	TPL5	0.75 days
66	**Lot Borings**	**9.75 days**
67	B1	0.75 days
68	B2	0.75 days
69	B3	0.75 days
70	B4	0.75 days
71	B5	0.75 days
72	B6	0.75 days
73	B7	0.75 days
74	B8	0.75 days
75	B9	0.75 days
76	B10	0.75 days
77	B11	0.75 days
78	B12	0.75 days
79	B13	0.75 days
80	Demobilization	1 day
81	**Complete Parking Lot**	0 days
82	**Waste Management**	**31.5 days**
83	IDW Sampling	0 days
84	IDW Removal	2 days

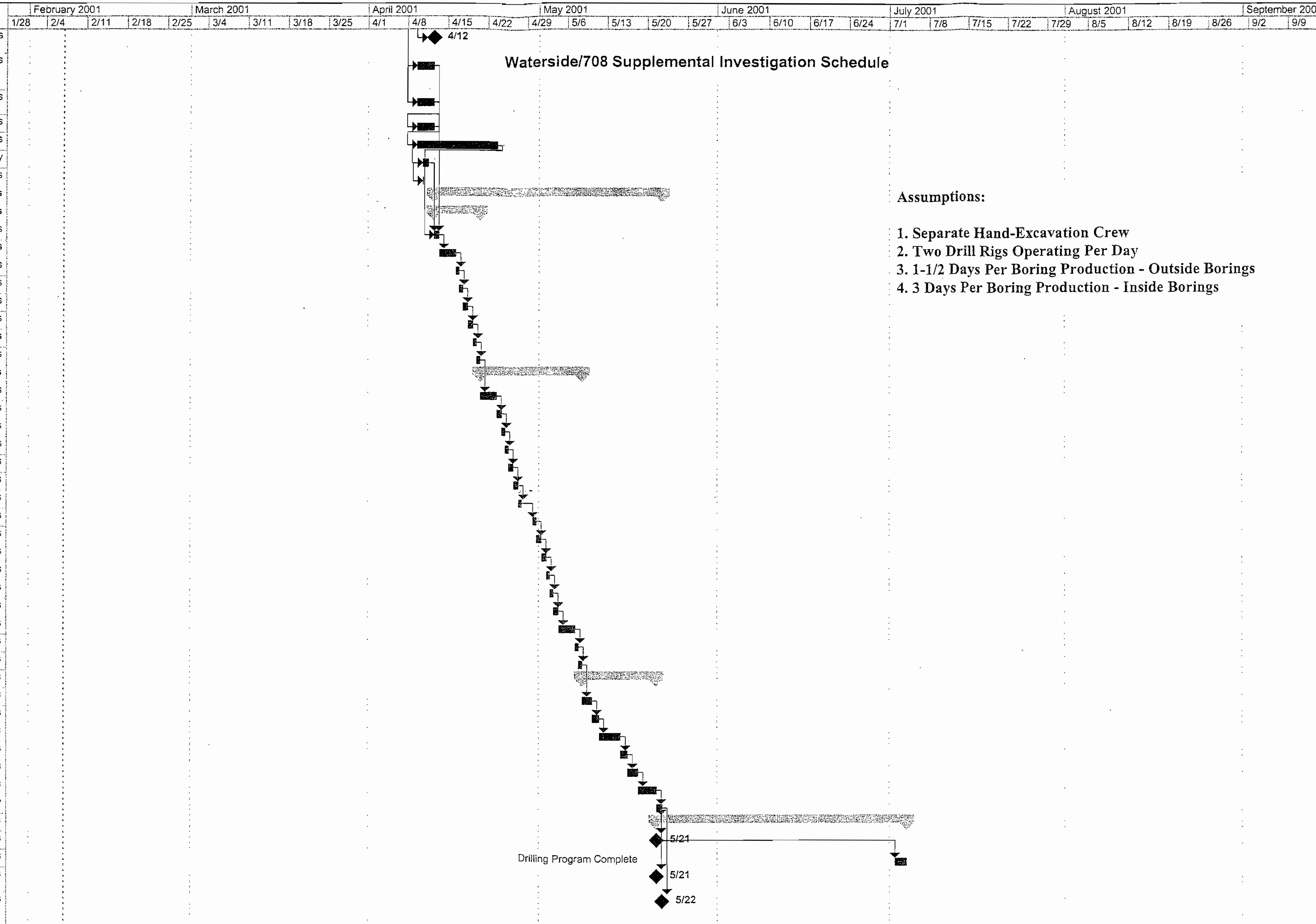


Assumptions:

1. Separate Hand-Excavation Crew
2. Two Drill Rigs Operating Per Day
3. 1-1/2 Days Per Boring Production

Waterside/708 Supplemental Investigation Schedule

ID	Task Name	Duration
85	**Drilling Start - Waterside/708**	0 days
86	Sidewalk Permit Acquisition - Waterside/708	3 days
87	One Call Notification for Sidewalk Drilling	3 days
88	Utility Clearance	3 days
89	Hand/Vacuum Excavation	10 days
90	Mobilization	1 day
91	Work Permits & Rig Inspection	0.2 days
92	**Waterside/708 Drilling**	**28 days**
93	**Sidewalk Borings**	**6 days**
94	WS1-1	0.75 days
95	WS1-9	0.75 days
96	WS1-10	0.75 days
97	WS1-11	0.75 days
98	708-1	0.75 days
99	708-7	0.75 days
100	708-8	0.75 days
101	708-9	0.75 days
102	**Lot Borings**	**12 days**
103	WS1-4	0.75 days
104	WS1-5	0.75 days
105	WS1-6	0.75 days
106	WS1-7	0.75 days
107	WS2-3	0.75 days
108	WS2-4	0.75 days
109	WS2-5	0.75 days
110	WS2-6	0.75 days
111	WS2-7/TWS2-1	0.75 days
112	WS2-8/TWS2-2	0.75 days
113	WS1-8/TWS1-1	0.75 days
114	708-4	0.75 days
115	708-5	0.75 days
116	708-6	0.75 days
117	SH-1	0.75 days
118	FH-1	0.75 days
119	**Inside Borings**	**9 days**
120	WS1-2	1.5 days
121	WS1-3	1.5 days
122	WS2-1	1.5 days
123	WS2-2	1.5 days
124	708-2	1.5 days
125	708-3	1.5 days
126	Demobilization	1 day
127	**Waste Management**	**31.25 days**
128	IDW Sampling	0 days
129	IDW Removal	2 days
130	**Complete Drilling Program**	0 days
131	**Complete Supplemental Investigation**	0 days



Assumptions:

1. Separate Hand-Excavation Crew
2. Two Drill Rigs Operating Per Day
3. 1-1/2 Days Per Boring Production - Outside Borings
4. 3 Days Per Boring Production - Inside Borings

Appendix B

Temporary Grounding Specification

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
4 IRVING PLACE
NEW YORK,NY 10003

SUBSTATION AND TRANSMISSION
ENGINEERING DEPARTMENT

SPECIFICATION EI-1027

REVISION 1

APRIL, 1995

SPECIFICATION FOR THE TEMPORARY GROUNDING OF CONSTRUCTION EQUIPMENT

FILE: ELECTRICAL SUBSTATION, PLANT AND PROTECTION MANUAL NO. 7

TABLE OF CONTENTS

SPECIFICATION FOR THE TEMPORARY GROUNDING OF CONSTRUCTION EQUIPMENT

1.00 SCOPE

1.01 This specification covers the bondings and grounding of cranes, hoists, pumps belt-driven apparatus, trucks and other mobile equipment required during the construction of facilities for the Consolidated Edison Company of New York, Inc. herein called the Company. It also covers the grounding of "Temporary Light & Power Supplies" used during the construction activity. This specification is also applicable to all maintenance or repair work requiring use of construction equipment included in this specification.

1.02 In the case of construction equipment, it is the intent of this specification to detail methods of establishing grounds for the dissipation of static electric charges imposed on, or generated by, that equipment or its inadvertent connection to the temporary light & power supply. Grounding to provide protection from accidental power crosses, i.e. the inadvertent contact with high voltage conductors, is not included.

1.03 In the case of temporary light & power supplies, this specification covers the grounding methods to be employed to protect against the inadvertent contact of those supplies with personnel, material and equipment, ground, and adjacent phase conductors.

1.04 This specification is not to be applied to any permanent grounding installation. Such installations are covered by separate specifications and drawings specifically prepared for that purpose. This specification does not supersede any of the requirements established by such specifications or drawings.

2.00 STANDARD

2.01 The grounding of the specified equipment shall be in accordance with the latest published ANSI, IEEE, NFPA NEC and OSHA standards. The design, testing and inspection standards for the individual pieces of equipment as published by the various authorities, are in no way altered or superseded by this specification.

3.00 APPLICATION

3.01 This specification applies to both new construction, i.e. at switching stations and substations where no energized electrical equipment exists, as well as to construction work taking place in existing operating facilities throughout the Con Edison System.

4.00 TEMPORARY LIGHT AND POWER

4.01 Generally, the temporary light & power supply will be below 600 volts, usually 208 volts, 3 phase, 4 wire. Where higher voltages are required for a specific project, the Company will issue detailed drawings and specifications to cover these situations.

4.02 Where large temporary loads are anticipated, the installation of step-down transformers will be required. In such cases, the Company will issue detailed drawings and specifications to cover these installations.

4.03 When the L&P service is brought into a new site, the service equipment shall be of the appropriate rating. The service equipment shall be housed in enclosures suitable to the location. The enclosures for such equipment, i.e. meters, current transformers, fused safety switches, fuse or circuit breaker panels, cable buses, etc. shall be effectively grounded as detailed in this specification.

4.04 The ground path from circuits, equipment, structures, enclosures, conduit, etc. shall be continuous and have sufficient current carrying capacity to safely conduct current liable to be imposed on it. The neutral conductor in a service supply shall not be used for grounding purposes.

4.05 The size of the grounding conductor should not be less than the sizes given in Table No. 1.

4.06 The ground cable shall be connected to a metallic water pipe, if available, with a pipe clamp of the appropriate size. Burndy Mfg. Co. clamps or Company approved equals are to be used.

4.07 If a metallic water pipe is not readily available at the site, connection shall be made to driven rods as detailed in Paragraphs No. 10.00 to 10.06.

4.08 All branch circuits for portable electric tools shall be protected with ground fault circuit interrupters to comply with the latest published OSHA regulations.

4.09 Temporary lighting for construction sites shall be equipped with bulb-guards. For outdoor locations the lighting and various lighting components shall be specifically designed for such use. Portable electric lights for wet locations (such as tunnels) shall be operated at no more than 12 volts.

5.00 ELECTRIC ARC WELDING AND CUTTING

5.01 The frames of electric arc welding and cutting machines shall be grounded either through a third wire in the cable containing the power conductors or through a separate wire which shall be grounded at the power source, transformer, distribution panel, etc. (See Paragraph No. 4.00 to 4.09).

5.02 The ground return cable shall have a current carrying capacity equal to or exceeding the output capacity of the welding machine which it services.

5.03 When a single ground return cable services more than one machine, the current carrying capacity shall be equal to or exceed the maximum output capacities of all the machines it services.

5.04 Conduits containing electrical circuits, oil pipe lines and gas pipe lines shall not be used as a ground return path because the continuity of this path cannot be assured.

6.00 CRANES. HOISTS, DERRICKS, ETC.

6.01 Cranes, mobile or fixed derricks; crawlers; floating cranes; extensible boom platforms, serial ladders; articulating boom platforms, or any combination of the above, shall be effectively grounded.

6.02 The size of the grounding conductor shall not be less than #4/0 AWG, insulated, flexible cable, specification EO-695.

6.03 The ground cable shall be connected to a metallic pipe, if available, with a pipe clamp of the approved size.

Burndy Mfg. Co. clamps or Company approved equals are to be used.

6.04 If a metallic water pipe is not readily available at the site, connection shall be made to driven rods as detailed in Paragraph No. 10.00 to 12.06.

6.05 In operating stations all construction equipment shall be grounded to the station ground grid. The grounding cable shall be done with two(2) #4/0 AWG, insulated, flexible cables, specification EO-695. ?

6.06 The grounding cable shall be equipped with a cable clamp for attachment to the equipment to be protected. The cable clamp shall be as manufactured by A.B. Chance Mfg. Co., including a cable ferrule, or Company approved equal.

6.07 Equipment with rotating metallic platforms or bases shall be grounded at the platforms. Grounding of only the chassis is not acceptable. (Manufacturer's documented prove that the platforms or bases are factory grounded is sufficient, however the equipment shall be retested after repair or any modifications that may affect the grounding of the rotating metallic platform or base).

6.08 The grounding cable shall be attached to a cable riser connected to the station ground grid by a cable clamp as manufactured by Burndy. Type GX, Cat. No. GX3929, or Company approved equal.

6.09 Extensible boom platforms or articulated boom platforms made of FRP (fiberglass reinforced plastics) or other insulating materials shall be grounded at the base only. No grounding cables shall be attached to the booms or insulated platforms. The method of grounding shall be as described in Paragraphs No. 6.01 to 6.05.

7.00 PUMPS, FILTERS AND OTHER BELT-DRIVEN EQUIPMENT

7.01 Belt driven equipment, such as: pumps, filter-presses, etc. generate large amounts of static electricity (regardless of the proximity of energized equipment). Grounding of such equipment, is, therefore, essential. The grounding method and appurtenances shall be as described in Paragraphs No. 6.01 to 6.05.

8.00 RUBBER TIRED VEHICLES

8.01 Vehicles equipped with pneumatic rubber tires shall be grounded as described in Paragraphs No. 6.01 to 6.05.

9.00 CLEARANCES

9.01 In addition to using proper grounding practices, safety clearances to energized equipment must also be observed. The minimum working clearances are given in Table No. 2. In cases where such clearances cannot be maintained and the energized equipment cannot be taken out of service, the Corresponding Engineering Department should be consulted to review deviations from these values.

For maintenance work in areas with high voltage energized equipment, the recommended clearances for cranes, hoists, derricks and similar are: 15 feet for up to 138 kV and 20 feet for 345 kV equipment. Lower clearances are acceptable when working with the crane or similar construction equipment near the grounded end of an open disconnect switch. In such situation the construction equipment shall maintain a clearance equal to the open gap between the live and grounded end of the disconnect switch.

For other situations in which the minimum clearances specified in Table No. 2 cannot be maintained during maintenance work, the horizontal and vertical clearances of unguarded parts as specified in the National Electric Safety Code Table 124-1. (Clearance from Live Parts) shall be the lowest acceptable. For convenience, copy of the table is attached to this Specification.

If the minimum clearances specified in Table 124-1 of the National Electric Safety Code cannot be maintained, the area shall be protected by guards installed at clearances specified in Table 124-1 column 4. (Clearance guard to live parts).

9.02 Clearances from energized equipment to stationed construction or maintenance equipment (that is not in use) such as cranes, hoist, derricks as well as rubber tired vehicles such as trucks or tankers shall correspond to the values given in Table 124-1 of the National Electric Safety Code. The stationed equipment shall be grounded as per paragraphs 6.01 to 6.05 of this specification.

9.03 The working clearances given in Table No. 2 are intended solely for general construction operations and do not apply to glove-hand or hot-stick operations as detailed in the Company's "General Rules & Regulations" book. The OSHA standards for transmission and distribution do not apply in these construction situations.

10.0 ESTABLISHING DRIVEN GROUNDS

10.01 Where an effective ground such as a metallic water pipe, an existing station ground grid, etc. is not readily available, a ground shall be established by driving one or more ground rods and interconnecting them as required. The impedance of the grounding system shall be sufficiently low to limit the potential above ground and to result in the operation of the protective devices. The maximum tolerable ground resistance of driven rods is 20 ohms. Sufficient ground rods must be driven to achieve and maintain this value. The resistivity of the different soils will change with their composition, the moisture content and the temperature. These factors must be taken into consideration when establishing the ground.

10.02 The ground rods shall be driven to a minimum of 10'-0" whenever possible. In locations where this is not possible, shorter grounds may be used. Where ground rods cannot be driven, bare grounding cable of sufficient length to achieve 25 ohms ground resistance should be buried near the surface (max. depth 2'-0") or wire-mesh mat installed. The ground rods shall be driven below grade level to avoid tripping and shock hazards.

10.03 Ground rods can be obtained in standard lengths, from 5 to 30 feet, from the Copperweld Bimetallic Division or other distributors. The rods should be ordered with a type AB ground rod clamp and driving bolts. Equivalent ground rods, approved by the Company in advance, may also be used.

10.04 Wire mesh for grounding may be obtained from the same manufacturer.

10.05 Grounding cable connections to ground rods, building steel or underground cable taps shall be done by the exothermic method (Cadweld or Thermoweld).

10.06 Where the soil resistivity is very high, use of low resistivity material such as GEM by ERICO Product Inc., SANEARTH by SANKOSHA-USA or Bentonite is recommended to obtain the required ground resistance.

11.0 REMOVAL OF TEMPORARY GROUNDS

11.01 After completion of work, all temporary grounds and associated equipment or connections shall be removed.

Richard P. Fogarty

Richard P. Fogarty, Manager
Area Substation Engineering (North)
Substation and Transmission Engineering Department

D. A. Mark/dn

Attachments
Table No. 1
Table No. 2
N.E.S.C. 1993 edition paragraph 124

REVISION:	FILE:
General revision, updated table 2, changed format. Review Date: April, 2000	Electrical Substation Plant and Protection Manual No. 7. Section 5 Engineering Instructions.

TABLE NO. 1
COPPER WIRE SIZE OF GROUNDING CONDUCTORS, FOR VARIOUS SIZES OF POWER CONDUCTORS

AWG SIZE OF CONDUCTOR	MINIMUM SIZE OF POWER GROUNDING CONDUCTORS
#6 or smaller	#8 stranded
#4	#6 stranded
#2	#4 stranded
#2/0	#2/0 stranded
#4/0	#2/0 stranded

TABLE NO. 2
MINIMUM WORKING CLEARANCES TO ENERGIZED CIRCUITS*

NOMINAL OPERATING VOLTAGE (PHASE TO PHASE) VOLTS	MINIMUM CLEARANCE METAL TO METAL FROM WORKER TO LIVE PARTS LOCATED ON ONE SIDE	ON TWO OPPOSITE SIDES
0 to 208	3	3
208 to 1,000	3 1/2	4
1,000 to 4,400	4	5
4,400 to 15,000	5	6
15,000 to 35,000	6	9
35,000 to 115,000	8	10
138,000	10	12
220,000	15	
345,000	19	
500,000	24	

Minimum working clearances are in accordance with the National Electric Code and National Electric Safety Code latest revision.

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A. The equipment has been isolated and protected as prescribed for dead work including a work permit where required.

B. The enclosure has been purged and thoroughly ventilated.

C. All valves to the emulsifier, CO2 or gas supply shall be closed, locked and tagged.

D. Tests shall be made by qualified personne to make certain that combustible and toxic gases that may be generated are below hazardous levels and that oxygen is maintained at not less than 19.5 percent.

E. Approved respiratory equipment shall be available for possible emergency. Suitable rescue equipment and properly attended life lines shall also be available.

F. Periodic tests shall be made to assure that the conditions of item "D" above are maintained.

PROTECTIVE DEVICES

2.13 Tested insulated protective tools, protective cover up equipment and personal protective equipment shall bear a stamp indicating that

they have been tested and approved for use at the applicable voltage and the due date for next retest. Equipment shall not be used after retest date.

2.14 When working on or near energized equipment, employees shall use rubber gloves provided by the Company and approved for the voltage to be worked on.

They shall make a careful visual inspection and air test on each glove at the time the gloves are issued. Rubber gloves shall be visually inspectd by the wearer for defects and shall be air-tested before use each day and at other times if there is cause to suspect any damage.

Gloves found to be defective because of abrasions, holes or cuts, shall not be used and the employee shall puncture a small hole within 1/2 inch of the edge of the cuff, through which a red "Defective Material" tag shall be tied. A defective glove shall be replaced immediately.

2.15 Approved rubber gloves shall always be worn with leather protectors.

2.16 Approved rubber gloves must always be worn on both hands when opening access doors exposing live electrical equipment, during the operation of making equipment safe for work or during any subsequent changes to the status of the equipment.

2.17 Rubber protective devices and leather protectors must be kept free from oil, and when not in use they shall be stored on racks or kept in containers provided for that purpose. When storing, avoid proximity to sharp tools or objects.

2.18 Leather protectors damaged by holes, deep cuts, torn stitching or open seams shall be replaced.

2.19 An employee shall wear approved rubber gloves with leather protectors when using portable electrically operated tools near exposed live low voltage equipment. The grounding wire of the tools SHALL NOT be used and the tools shall be tested before using to make certain that the exposed metal parts are not alive due to defects within the tools.

2.20 Rubber sleeves and other rubber insulating protective devices shall be subjected to a careful visual inspection prior to their use. A defective protective device shall be replaced immediately and it shall have a red "Defective Material" tag attached to it.

STOP TAGS

2.21 The black and white striped stop tag is installed on equipment where a change of

status would improperly reduce the protection for work. This protection includes both the matter of keeping switches and equipment open for isolation and/or keeping other switches or equipment closed for maintaining protective grounds, short circuits or other protection. These tags are also used on mechanical equipment, steam, gas, air and oil valves.

WORK PERMITS

2.22 No work shall be started in a generating station, substation or within the enclosure of a station yard without the knowledge of the operating authority having jurisdiction. If the work to be done affects operating equipment a work permit, written or oral, must be obtained before starting work.

2.23 Written work permits and written test permits shall be prepared in duplicate, one copy being retained by the operator in charge and the other issued to the person in charge of the work.

2.24 After equipment has been rendered inoperative and been protected for work, no person shall remove any Stop tags, locks, etc. or cut in or start any switches or valves which may affect the equipment unless

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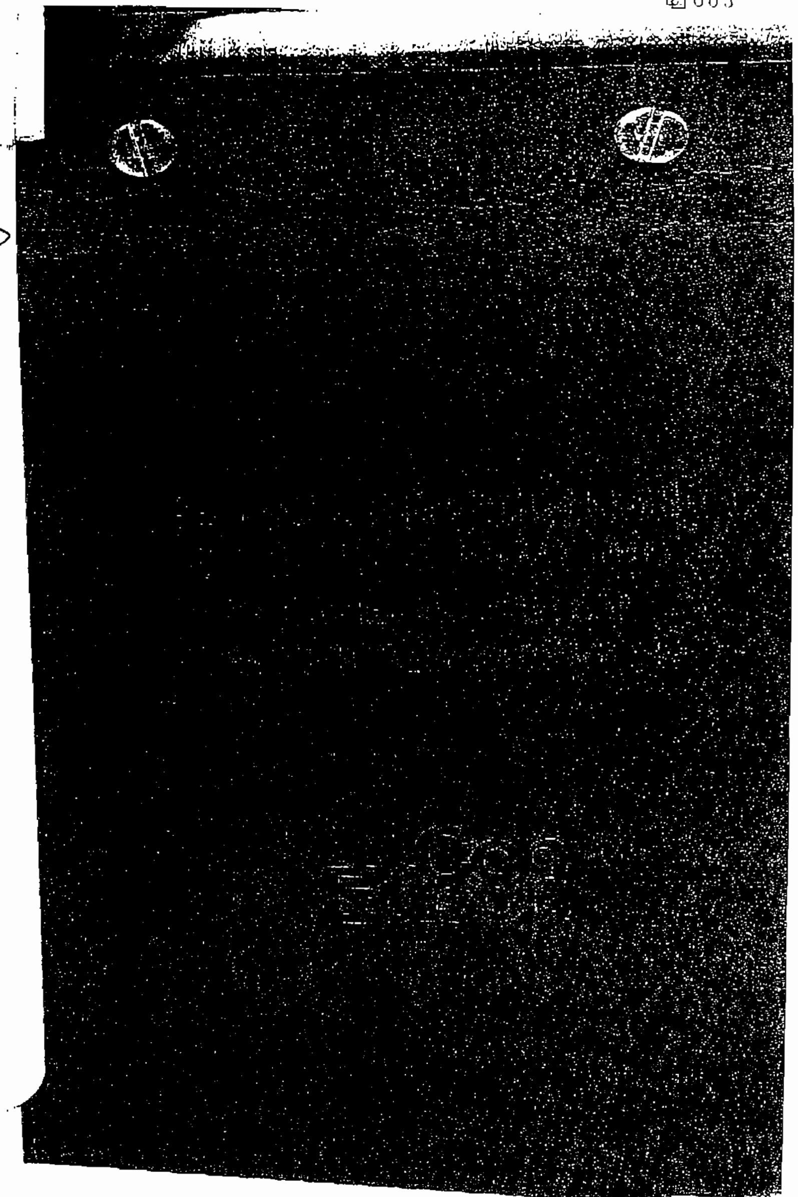


7.19 PROTECTIVE EQUIPMENT

HOT-STICK METHOD

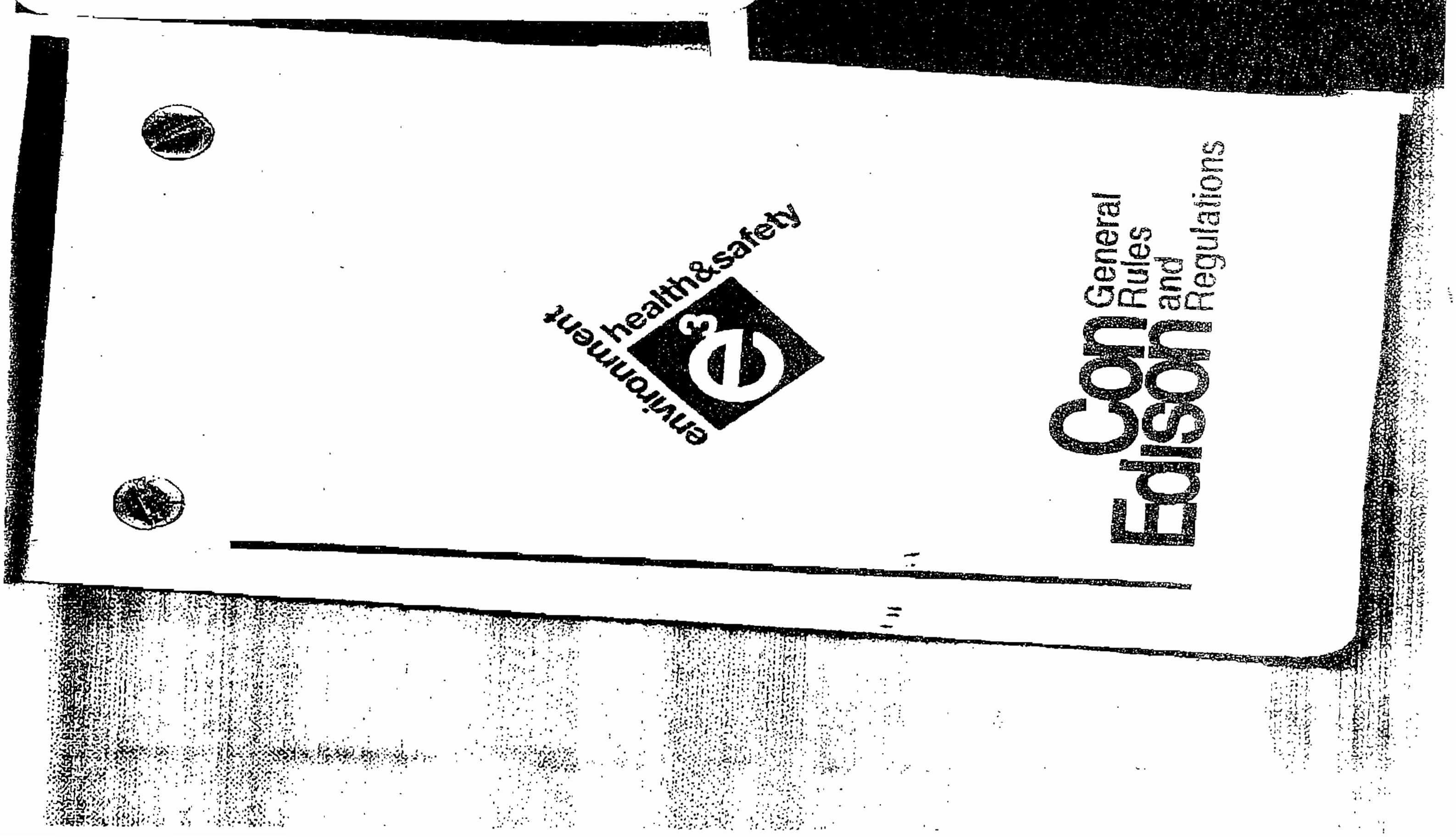
7.19.1 Personal Protective Equipment (Gloves and Sleeves)

Personal protective equipment when required shall be in accordance with the following chart:

Voltage (Phase to Phase)	Tested Gloves	Voltage Sleeves
600V TO 5KV	15KV	15KV
5.1KV TO 15KV	15KV	15KV
15.1KV TO 35KV	35KV	15KV*

*Class #2 Tested at 20KV

In addition to the daily inspection, this personal protective equipment shall be tested in accordance with the schedule in the latest Engineering Specifications and shall not be used after retest date.



Appendix C

Responsibility Matrix

APPENDIX C
FIRST AVENUE PROPERTIES
SUPPLEMENTAL SOIL INVESTIGATION PROGRAM RESPONSIBILITY MATRIX

Activity	Primary	Secondary	Remarks
Drilling Method	TRC	Warren George	
Borehole Logging	TRC/Langan	--	
Decon Pad	Warren George	--	
Rig/Equipment Decon	Warren George	--	
Venting Exhaust from Buildings	Warren George	--	
Concrete Coring	Warren George	--	
Drilling & Related Activities	Warren George	--	
Hand/Air Knife Excavation	Warren George	--	
Work Permits	Con Edison	TRC	
Electrical Power - Inside Coring	Con Edison	Warren George	220 volt, 50 amps, 3 phase
Utility Clearance	NAEVA Geophysics	NA	Input from TRC, Con Edison, Warren George Triboro Bridge/Tunnel Authority in selected locations
Street/Sidewalk Drilling Permits	Warren George	--	
Utility One Call	Warren George	--	5 days in advance
Pit Covering/Backfillling Boreholes and test pits	Warren George	--	
DOT Street Permits	Warren George	TRC	
Drum Transport/Supply/Moving	Warren George	--	
Fluid Control (capturing water, fluids)	Warren George	--	Berm construction, absorbent material, vacuuming, drumming
Clean Fill Source/Handling	Warren George	--	
Supply Drums	Warren George	--	
Supplying Pallets	Con Edison	--	
Spill Control	Warren George	--	Oil absorbent pads, vacuuming, absorbent
Waste Sampling	TRC	--	
Waste Storage and Disposal	TRC	Warren George/Con Ed	Assistance from Con Ed
Security	Warren George	--	Con Ed to provide space on property
Health & Safety	TRC	Warren George	
Surveying	GEOD	TRC/Langan	
Reconciling Daily Drilling Work	TRC/Warren George	Langan	
Drilling Schedule Control	TRC/Langan	--	
Geotechnical Sampling 8 oz. Jars	Warren George	--	
Analytical/Sampling Equipment	TRC	--	
Solid Waste Containers and Removal	Warren George	--	
Transport Drilling Cores	Langan	Warren George	
Disposal of Asphalt, Concrete Cores	Warren George	Langan	

Appendix D

Quality Assurance Project Plan

Supplemental Soil Investigation
Quality Assurance Project Plan (QAPP)

First Avenue Properties
New York, New York

Waterside Generating Station
708 First Avenue
Kips Bay Fuel Terminal
Parking Lot

Prepared by

TRC Environmental Corporation
1200 Wall Street West
Suite 200
Lyndhurst, New Jersey 07071

February 2001

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APPENDICES

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) presents the organization, objectives, planned activities, and specific quality assurance/quality control (QA/QC) procedures associated with the Supplemental Soil Investigation at the First Avenue Properties in New York, New York. A task-specific addendum to this QAPP will be provided for future investigations at this site.

The QAPP will describe specific protocols for field sampling, sampling handling and storage, chain of custody, laboratory analysis, and data handling and management. Preparation of the QAPP was based on EPA QAPP guidance documents, including:

- *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations (EPA QA/R-5, October 1998), and*

- *Guidance for Quality Assurance Project Plans (EPA QA/G-5, February 1998).*

Refer to Section 1 of the Work Plan for a description of the site. Refer to Section 1.1 of the Work Plan for a list of project quality objectives. The objectives will be achieved by the sampling and analysis program shown in Tables 1,2 and 3 of the Work Plan. The data generated from the analysis of samples will be used to determine the quantity and levels of contamination and to identify impacted targets. A list of the parameters to be analyzed, including their respective quantitation limits (QLs), and data quality levels (DQLs), is shown in Table 1.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

TRC will coordinate and manage the Supplemental Soil Investigation sampling and analysis program, data reduction, QA/QC, data validation, analysis, and reporting. TRC will direct the sampling activities and coordinate the laboratory and drilling activities. The TRC Project QA officer will be Ms. Elizabeth Denly of TRC.

Ms. Elizabeth Denly, TRC's QA Chemist, will insure that the QA/QC plan is followed, implement the QA/QC Plan, and oversee data validation. Ms. Denly will provide oversight and technical support for the sampling and analytical procedures followed in this project. This individual has the broad authority to approve or disapprove project plans, specific analyses, and final reports. The TRC Project QA Officer is independent from the data generation activities. In general, the QA officer will be responsible for reviewing and advising on all QA/QC aspects of this program.

The laboratory will be Accutest Laboratories of Dayton, New Jersey. Accutest is a New York State Department of Health ELAP CLP certified laboratory. The laboratory will communicate directly with TRC regarding the analytical results and reporting. Accutest will be responsible for providing all labels, sample jars, field blank water, shipping coolers, and laboratory documentation.

3.0 QA OBJECTIVES FOR DATA MANAGEMENT

All analytical data will be provided by the laboratory using New York State Analytical Services Protocol (ASP) Category B deliverable format.

All analytical measurements will be made so that the results are representative of the media sampled (soil and waste characterization) and the conditions measured. Data will be reported in consistent dry weight units: i.e., µg/kg and/or mg/kg for the soil matrix and in µg/L or mg/L for aqueous samples.

Table 2 presents the proposed samples, sampling and analytical parameters, analytical methods, sample preservation requirements, containers, and estimated number of samples for the Supplemental Soil Investigation program.

Table 3 presents a summary of the sampling and analysis program for the planned soil and investigation-derived waste (IDW) samples. It should be noted that parameters followed by STARS/TAGM in parentheses indicate that the required analyte list is a combination of the compounds included in both the STARS and TAGM guidance (see Attachment 1).

QLs are laboratory-specific and reflect those values achievable by the laboratory performing the analyses. DQLs are those reporting limits required to meet the objectives of the program (i.e., program action levels, cleanup standards, etc.). Data Quality Objectives (DQOs) define the quality of data and documentation required to support decisions made in the various phases of the data collection activities. The DQOs are dependent on the end uses of the data to be collected and are also expressed in terms of objectives for precision, accuracy, representativeness, completeness, and comparability.

The analytical methods to be used at this site provide the highest level of data quality and can be used for purposes of risk assessment, evaluation of remedial alternatives and verification that cleanup standards have been met. However, in order to ensure that the analytical methodologies are capable of achieving the DQOs, measurement performance criteria have been set for the analytical measurements in terms of accuracy, precision, and completeness.

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting which will provide results that are scientifically valid, and the levels of which are sufficient to meet DQOs. Specific procedures for sampling, chain of custody, laboratory instruments calibration, laboratory analysis, reporting of data, internal quality control, and corrective action are described in other sections of this QAPP.

Table 4 presents the precision and accuracy requirements for each parameter to be analyzed. For quantitation limits, the laboratory will be required to attempt to meet or surpass the parameter-specific limits listed in the STARS and/or TAGM guidance, whichever is lower (Attachment 1). In certain instances, if the STARS or TAGM criteria are not achievable due to analytical limitations, the laboratory will report the lowest possible quantitation limit (See Table 1 for affected analytes). The QA objectives are defined as follows:

- ***Accuracy*** is the closeness of agreement between an observed value and an accepted reference value. The difference between the observed value and the reference value includes components of both systematic error (bias) and random error.

  Accuracy in the field is assessed through the adherence to all field instrument calibration procedures, sample handling, preservation, and holding time requirements and through the collection of equipment blanks prior to the collection of samples for each type of equipment being used (e.g., split spoons).

  The laboratory will assess the overall accuracy of their instruments and analytical methods (independent of sample or matrix effects) through the measurement of "standards," materials of accepted reference value. Accuracy will vary from analysis to analysis because of individual sample and matrix effects. In an individual analysis, accuracy will be measured in terms of blank results, the percent recovery (%R) of surrogate compounds in organic analyses, or %R of spiked compounds in matrix spikes (MSs) and/or matrix spike duplicates (MSDs) and/or laboratory control samples (LCSs). This gives an indication of expected recovery for analytes tending to behave chemically like the spiked or surrogate compounds. Table 4 summarizes the laboratory accuracy requirements.

- ***Precision*** is the agreement among a set of replicate measurements without consideration of the "true" or accurate value: i.e., variability between measurements of the same material for the same analyte. Precision is measured in a variety of ways including statistically, such as calculating variance or standard deviation.

  Precision in the field is assessed through the collection and measurement of field duplicates (one extra sample in addition to the original field sample). Field duplicates will be collected at a frequency of one per twenty investigative samples per analytical parameter, with the exception of the TCLP parameters. Precision will be measured through the calculation of relative percent differences (RPDs). The resulting information will be used to assess sampling and analytical variability. Field duplicate RPDs must be <50 for soil samples. These criteria apply only if the sample and/or duplicate results are >5x the quantitation limit; if both results are <5x the quantitation limit, the criterion will be doubled.

  Precision in the laboratory is assessed through the calculation of RPD for duplicate samples. For organic analyses, laboratory precision will be assessed through the analysis of MS/MSD samples and field duplicates. For the inorganic analyses, laboratory precision will be assessed through the analysis of matrix duplicate pairs and field duplicate pairs. MS/MSD samples or matrix duplicate pairs will be performed at a frequency of one per twenty investigative samples per parameter. Table 4 summarizes the laboratory precision requirements.

- ***Completeness*** is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. "Normal conditions" are defined as the conditions expected if the sampling plan was implemented as planned.

Field completeness is a measure of the amount of (1) valid measurements obtained from all the measurements taken in the project and (2) valid samples collected. The field completeness objective is greater than 90 percent.

Laboratory completeness is a measure of the amount of valid measurements obtained from all valid samples submitted to the laboratory. The laboratory completeness objective is greater than 95 percent.

- ***Representativeness*** is a qualitative parameter which expresses the degree to which data accurately and precisely represent either a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. To ensure representativeness, the sampling locations have been selected to provide coverage over a wide area and to highlight potential trends in the data.

  Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Work Plan and QAPP are followed and that proper sampling, sample handling, and sample preservation techniques are used.

  Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate methods, and meeting sample holding times.

- ***Comparability*** expresses the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Work Plan and QAPP are followed and that proper sampling techniques are used. Maximization of comparability with previous data sets is expected because the sampling design and field protocols are consistent with those previously used.

  Comparability is dependent on the use of recognized EPA or equivalent analytical methods and the reporting of data in standardized units. Laboratory procedures are consistent with those used for previous sampling efforts.

Table 1
Chemical Parameters, Quantitation Limits and Data Quality Levels
First Avenue Properties – Supplemental Soil Investigation QAPP

Parameter	QL	DQL[1]
Volatile Organic Compounds (µg/kg) –TAGM[3]		
Acetone	5	200
Benzene	2	60
2-Butanone	5	300
Carbon Disulfide	2	2700
Carbon Tetrachloride	2	600
Chlorobenzene	2	1700
Chloroethane	2	1900
Chloroform	2	300
Dibromochloromethane	2	NS
1,2-Dichlorobenzene	2	7900
1,3-Dichlorobenzene	2	1600
1,4-Dichlorobenzene	2	8500
1,1-Dichloroethane	2	200
1,2-Dichloroethane	2	100
1,1-Dichloroethene	2	400
trans-1,2-Dichloroethene	2	300
1,3-Dichloropropane	2	300
Ethylbenzene	2	5500
Freon 113	2	6000
Methylene chloride	5	100
4-Methyl-2-pentanone	5	1000
Tetrachloroethene	2	1400
1,1,1-Trichloroethane	2	800
1,1,2,2-Tetrachloroethane	2	600
1,2,3-Trichloropropane	2	400
1,2,4-Trichlorobenzene	2	3400
Toluene	2	1500
Trichloroethene	2	700
Vinyl chloride	2	200
Xylenes	2	1200
Isopropylbenzene	2	5000
n-Propylbenzene	2	14000
p-Isopropyltoluene	2	11000
1,2,4-Trimethylbenzene	2	13000
1,3,5-Trimethylbenzene	2	3300
n-Butylbenzene	2	18000
sec-Butylbenzene	2	25000
t-Butylbenzene	2	100[2]
MTBE	2	120

Table 1
Chemical Parameters, Quantitation Limits and Data Quality Levels
First Avenue Properties – Supplemental Soil Investigation QAPP

Parameter	QL	DQL[1]
Polynuclear Aromatic Hydrocarbons (µg/kg) –TAGM		
Acenaphthene	66	50000
Acenaphthylene	66	41,000
Anthracene	66	50000
Benzo(a)anthracene	66	224
Benzo(a)pyrene	**66**	**61**
Benzo(b)fluoranthene	66	1100
Benzo(g,h,i)perylene	66	50000
Benzo(k)fluoranthene	66	1100
Chrysene	66	400
Dibenzo(a,h)anthracene	**66**	**14**
Fluoranthene	66	50000
Fluorene	66	50000
Indeno(1,2,3-cd)pyrene	66	3200
2-Methylnaphthalene	66	36,400
Naphthalene	66	13000
Phenanthrene	66	50000
Pyrene	66	50000
Metals (mg/kg) – TAGM		
Aluminum	20	NS
Antimony	1.0	NS
Arsenic	1.0	8.0
Barium	20	300
Beryllium	**0.5**	**0.16**
Cadmium	0.5	1.0
Calcium	500	NS
Chromium	1.0	10
Cobalt	5.0	30
Copper	2.5	25
Iron	10	2000
Lead	1.0	NS
Magnesium	500	NS
Manganese	1.5	NS
Mercury	0.04	0.1
Nickel	4	13
Potassium	500	NS
Selenium	1	2
Silver	1	NS
Sodium	500	NS
Thallium	1	NS
Vanadium	5	150

Table 1
Chemical Parameters, Quantitation Limits and Data Quality Levels
First Avenue Properties – Supplemental Soil Investigation QAPP

Parameter	QL	DQL[1]
Zinc	2	20
PCBs (µg/kg)[4]		
Aroclor 1016	330	1000 Surface/ 10000 Subsurface
Aroclor 1221	330	1000 Surface/ 10000 Subsurface
Aroclor 1232	330	1000 Surface/ 10000 Subsurface
Aroclor 1242	330	1000 Surface/ 10000 Subsurface
Aroclor 1248	330	1000 Surface/ 10000 Subsurface
Aroclor 1254	330	1000 Surface/ 10000 Subsurface
Aroclor 1260	330	1000 Surface/ 10000 Subsurface
TCLP VOCs (µg/L)		
Benzene	**5**	**0.7[5]**
2-Butanone	25	200,000[6]
Carbon Tetrachloride	5	500[6]
Chlorobenzene	10	100,000[6]
Chloroform	25	6000[6]
1,4-Dichlorobenzene	25	7500[6]
1,2-Dichloroethane	10	500[6]
1,1-Dichloroethene	10	700[6]
Ethylbenzene	5	5[5]
Tetrachloroethene	5	700[6]
Toluene	5	5[5]
Trichloroethene	5	500[6]
Vinyl chloride	5	200[6]
Xylenes	**25**	**5[5]**
Isopropylbenzene	**10**	**5[5]**
n-Propylbenzene	**25**	**5[5]**
p-Isopropyltoluene	**25**	**5[5]**
1,2,4-Trimethylbenzene	**25**	**5[5]**
1,3,5-Trimethylbenzene	**25**	**5[5]**
n-Butylbenzene	**25**	**5[5]**
sec-Butylbenzene	**25**	**5[5]**
t-Butylbenzene	**25**	**5[5]**
MTBE	5	50[5]
TCLP PAHs (µg/L)		
Acenaphthene	2	20[5]
Anthracene	2	50[5]
Benzo(a)anthracene	**2**	**0.002[5]**
Benzo(a)pyrene	**2**	**0.002[5]**
Benzo(b)fluoranthene	**2**	**0.002[5]**
Benzo(g,h,i)perylene	**2**	**0.002[5]**

Table 1
Chemical Parameters, Quantitation Limits and Data Quality Levels
First Avenue Properties – Supplemental Soil Investigation QAPP

Parameter	QL	DQL[1]
Benzo(k)fluoranthene	**2**	**0.002[5]**
Chrysene	**2**	**0.0025**
Dibenzo(a,h)anthracene	2	50[5]
Fluoranthene	2	50[5]
Fluorene	2	50[5]
Indeno(1,2,3-cd)pyrene	**2**	**0.002[5]**
Naphthalene	2	10[5]
Phenanthrene	2	50[5]
Pyrene	2	50[5]
TCLP Metals (μg/L)		
Arsenic	5	5000[6]
Barium	200	100,000[6]
Cadmium	4	1000[6]
Chromium	10	5000[6]
Lead	3	5000[6]
Mercury	0.2	200[6]
Selenium	5	1000[6]
Silver	10	5000[6]

[1] DQL based on TAGM Recommended Soil Cleanup Objectives (January 24, 1994) unless otherwise specified
[2] DQL based on STARS TCLP Alternative Guidance Values (August 1992)
[3] Includes QLs and DQLs for BTEX and MTBE when required individually for a particular sample
[4] DQL listed is for total PCBs
[5] DQL based on STARS TCLP Extraction Guidance Values (August 1992)
[6] DQL based on TCLP standards (SW-846 Chapter 7, Table 7-1)
QL=Quantitation Limit
DQL=Data Quality Level
NS = None specified
Compounds which will not achieve the DQL are highlighted.

Table 2
Estimated Number of Samples, Analytical Parameters, Methods, Preservation and Container Requirements
First Avenue Properties - Supplemental Soil Investigation QAPP

Sample Matrix	Analytical Parameter	Sample Type[1]	No. of Samples[2]	EPA Analytical Method	Sample Preservation	Holding Time[3]	Sample Container[4,5]
Soil/IDW	VOCs	Grab	34/3	SW 846 Method 8260B	Cool to 4^0 C; no headspace	7 days to analysis	(2) 2-oz. glass jars
Soil	BTEX	Grab	7	SW-846 Method 8260B	Cool to 4^0 C; no headspace	7 days to analysis	(2) 2-oz. glass jars
Soil	BTEX/MTBE	Grab	4	SW-846 Method 8260B	Cool to 4^0 C; no headspace	7 days to analysis	(2) 2-oz. glass jars
Soil/IDW	PCBs	Grab	4/3	SW 846 Method 8082	Cool to 4^0 C	7 days to extraction; 40 days from extraction to analysis	(1) 300 mL amber glass jar
IDW	Pesticides	Grab	3	SW-846 Method 8081A	Cool to 4^0 C	7 days to extraction; 40 days from extraction to analysis	(1) 300 mL amber glass jar
IDW	SVOCs	Grab	3	SW-846 Method 8270C	Cool to 4^0 C	7 days to extraction; 40 days from extraction to analysis	(1) 300 mL amber glass jar
Soil	PAHs	Grab	26	SW 846 Method 8270C	Cool to 4^0 C	7 days to extraction; 40 days from extraction to analysis	(1) 300 mL amber glass jar
Soil	Lead	Grab	6	SW 846 Method 6010B	Cool to 4^0 C	6 months to analysis	(1) 300 mL amber glass jar
Soil	Metals (TAGM)	Grab	26	SW-846 Method 6010B/7000 Series	Cool to 4^0 C	28 days to analysis for Hg; 6 months to analysis for other metals	(1) 300 mL amber glass jar
IDW	Metals (PP)	Grab	3	SW-846 Method 6010B/7000 Series	Cool to 4^0 C	28 days to analysis for Hg; 6 months to analysis for other metals	(1) 300 mL amber glass jar
Soil	GRO	Grab	9	SW-846 Method 8015B	Cool to 4^0 C; no headspace	7 days to analysis	(2) 2-oz. glass jars

Table 2
Estimated Number of Samples, Analytical Parameters, Methods, Preservation and Container Requirements
First Avenue Properties - Supplemental Soil Investigation QAPP

Sample Matrix	Analytical Parameter	Sample Type[1]	No. of Samples[2]	EPA Analytical Method	Sample Preservation	Holding Time[3]	Sample Container[4,5]
Soil/IDW	TCLP VOC	Grab	32/3	SW 846 Methods 1311/8260B	Cool to 4^0 C; no headspace	7 days to TCLP extraction; 7 days from TCLP extraction to analysis	(1) 60 ml VOC vial
Soil/IDW	TCLP SVOC or PAHs	Grab	19/3	SW 846 Methods 1311/ 8270C	Cool to 4^0 C	7 days to TCLP extraction; 7 days from TCLP extraction to SVOC extraction; 40 days from SVOC extraction to analysis	(1) 950 mL amber glass jar
IDW	TCLP Pesticides	Grab	3	SW-846 Methods 1311/8081A	Cool to 4°C	7 days to TCLP extraction; 7 days from TCLP extraction to pesticide extraction; 40 days from pesticide extraction to analysis	(1) 950 mL amber glass jar
IDW	TCLP Herbicides	Grab	3	SW-846 Methods 1311/8151A	Cool to 4°C	7 days to TCLP extraction; 7 days from TCLP extraction to herbicide extraction; 40 days from herbicide extraction to analysis	(1) 950 mL amber glass jar
Soil/IDW	TCLP Metals	Grab	19/3	SW 846 Methods 1311/ 6010B/7000 Series	Cool to 4^0 C	Hg: 28 days to TCLP extraction; 28 days from TCLP extraction to analysis Other Metals: 6 months to TCLP extraction; 6 months from TCLP extraction to analysis	(1) 500 mL amber glass jar

Table 2
Estimated Number of Samples, Analytical Parameters, Methods, Preservation and Container Requirements
First Avenue Properties - Supplemental Soil Investigation QAPP

Sample Matrix	Analytical Parameter	Sample Type[1]	No. of Samples[2]	EPA Analytical Method	Sample Preservation	Holding Time[3]	Sample Container[4,5]
Soil	TCLP Lead	Grab	13	SW 846 Methods 1311/ 6010B	Cool to 4^0 C	6 months to TCLP extraction; 6 months from TCLP extraction to analysis	(1) 500 mL amber glass jar
Soil/IDW	Ignitability	Grab	25/3	SW-846 Method 1010	Cool to 4^0 C	None specified	(1) 500 mL amber glass jar
Soil/IDW	Corrosivity	Grab	19/3	SW-846 Method 9045C	Cool to 4^0 C	As soon as possible (within 3 days of collection)	(1) 500 mL amber glass jar
Soil/IDW	Reactive cyanide	Grab	19/3	SW-846 Chapter 7, Section 7.3.3	Cool to 4^0 C; no headspace	As soon as possible (within 3 days of collection)	(1) 500 mL amber glass jar
Soil/IDW	Reactive sulfide	Grab	19/3	SW-846 Chapter 7, Section 7.3.4	Cool to 4^0 C; no headspace	As soon as possible (within 3 days of collection)	(1) 500 mL amber glass jar

[1] For soil samples, a six-inch sampling interval is the preferred sample size; however, sample volume recovery, analytical method requirements, and field conditions can affect the actual sample interval size. For these reasons, the actual sampling interval may change in order to obtain adequate volume.
[2] Actual number of samples may vary depending on field conditions, sample material availability, and field observations
[3] From date of sample collection
[4] I-Chem Series 300 bottles
[5] MS/MSDs require duplicate volume for all parameters
25/3=No. samples for soil characterization/No. Samples for investigation derived waste classification

Table 3
Summary of Sampling and Analysis Program
First Avenue Properties – Supplemental Soil Investigation QAPP

Analytical Parameter	39th Street Parking Lot	Kips Bay Terminal	Waterside Units and 708 First Avenue	IDW
BTEX		X		
BTEX/MTBE	X			
TCL VOCs				X
VOCs (STARS/TAGM)	X	X	X	
TCL SVOCs				X
PAHs		X	X	
PCBs	X			X
TCL Pesticides				X
PP Metals				X
TAGM Metals		X	X	
Total Lead	X			
GRO	X			
TCLP VOCs[1]	X	X	X	
TCLP PAHs[1]		X	X	
TCLP Metals[2]		X	X	
TCLP Lead	X			
TCLP VOCs (RCRA)				X
TCLP SVOCs (RCRA)				X
TCLP Pesticides (RCRA)				X
TCLP Herbicides (RCRA)				X
TCLP Metals (RCRA)				X
Ignitability	X	X	X	X
Corrosivity		X	X	X
Reactivity		X	X	X

IDW = Investigation-Derived Waste
BTEX = Benzene, Toluene, Ethylbenzene, Xylenes
MTBE = Methyl-tertbutylether
TCL = Target Compound List
VOCs = Volatile Organic Compounds
SVOCs = Semivolatile Organic Compounds
PAHs = Polynuclear Aromatic Hydrocarbons
PCBs = Polychlorinated Biphenyls
PP = Priority Pollutant
GRO = Gasoline Range Organics
TCLP = Toxicity Characteristic Leaching Procedure
RCRA = Resource Conservation and Recovery Act
TAGM = Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels (January 24, 1994)
STARS = Spill Technology and Remediation Series (Memo #1) (August, 1992)
[1] Analyte list based on STARS/TAGM compounds which exhibit TCLP standards based on the STARS document or SW-846
[2] Analyte list based on PP metals and barium but only for those metals which exhibit TCLP standards based on SW-846

Table 4
Data Quality Objectives: Precision and Accuracy
First Avenue Properties - Supplemental Soil Investigation QAPP

Parameter	Method	Matrix	Accuracy Control Limits		Accuracy Frequency Requirements	Precision (RPD) Control Limits		Precision Frequency Requirements
VOCs	SW-846 Method 8260B	Soil/IDW	Surrogates	% Rec.	Surrogates: All samples, standards, QC samples	Field Duplicates		Field Duplicates: One per 20
			1,2-Dichloroethane-d4	54-129				
			4-Bromofluorobenzene	58-137		RPD 50		
			Dibromofluoromethane	55-132				
			Toluene-d8	65-133				
			Matrix Spike Compounds		Matrix Spikes: One per 20	MS/MSDs	RPD	MS/MSDs: One per 20
			1,1-Dichloroethene	60-130		1,1-Dichloroethene	19	
			Trichloroethene	59-146		Trichloroethene	18	
			Benzene	64-132		Benzene	15	
			Toluene	48-145		Toluene	16	
			Chlorobenzene	56-137		Chlorobenzene	17	
BTEX and BTEX/MTBE	SW-846 Method 8260B	Soil	Surrogates	% Rec.	Surrogates: All samples, standards, QC samples	Field Duplicates		Field Duplicates: One per 20
			1,2-Dichloroethane-d4	54-129				
			4-Bromofluorobenzene	58-137		RPD 50		
			Dibromofluoromethane	55-132				
			Toluene-d8	65-133				
			Matrix Spike Compounds		Matrix Spikes: One per 20	MS/MSDs	RPD	MS/MSDs: One per 20
			Benzene	64-132		Benzene	15	
			Toluene	48-145		Toluene	16	
			Ethyl Benzene	49-143		Ethyl Benzene	20	
			Xylenes (total)	45-146		Xylenes (total)	17	
			MTBE	60-132		MTBE	15	

Table 4
Data Quality Objectives: Precision and Accuracy
First Avenue Properties - Supplemental Soil Investigation QAPP

Parameter	Method	Matrix	Accuracy Control Limits		Accuracy Frequency Requirements	Precision (RPD) Control Limits		Precision Frequency Requirements
PCBs	SW-846 Method 8082	Soil/IDW	Surrogates	% Rec.	Surrogates: All samples, standards, QC samples	Field Duplicates		Field Duplicates: One per 20
			Decachlorobiphenyl	23-149				
			Tetrachloro-m-xylene	26-126		RPD 50		
			Matrix Spike Compounds		Matrix Spikes: One per 20	MS/MSDs	RPD	MS/MSDs: One per 20
			Aroclor 1016	60-130		Aroclor 1016	26	
			Aroclor 1260	40-146		Aroclor 1260	27	
PAHs	SW-846 Method 8270C	Soil	Surrogates	% Rec.	Surrogates: All samples, standards, QC samples	Field Duplicates		Field Duplicates: One per 20
			Nitrobenzene-d5	27-124				
			2-Fluorobiphenyl	27-127		RPD 50		
			Terphenyl-d14	29-157				
			Matrix Spikes		Matrix Spikes: One per 20	MS/MSDs	RPD	MS/MSDs: One per 20
			Naphthalene	30-120		Naphthalene	28	
			2-Methylnaphthalene	36-126		2-Methylnaphthalene	28	
			Acenaphthylene	38-110		Acenaphthylene	31	
			Acenaphthene	32-122		Acenaphthene	30	
			Fluorene	31-133		Fluorene	29	
			Fluoranthene	35-128		Fluoranthene	27	
			Pyrene	25-139		Pyrene	33	
			Phenanthrene	24-135		Phenanthrene	29	
			Anthracene	28-132		Anthracene	29	
			Benzo(a)anthracene	32-129		Benzo(a)anthracene	24	
			Chrysene	29-128		Chrysene	30	
			Benzo(b)fluoranthene	34-139		Benzo(b)fluoranthene	31	
			Benzo(k)fluoranthene	24-137		Benzo(k)fluoranthene	30	
			Benzo(a)pyrene	35-126		Benzo(a)pyrene	29	
			Indeno(1,2,3-cd)pyrene	12-133		Indeno(1,2,3-cd)pyrene	35	
			Dibenzo(a,h)anthracene	18-139		Dibenzo(a,h)anthracene	33	
			Benzo(g,h,i)perylene	10-135		Benzo(g,h,i)perylene	33	

Table 4
Data Quality Objectives: Precision and Accuracy
First Avenue Properties - Supplemental Soil Investigation QAPP

Parameter	Method	Matrix	Accuracy Control Limits		Accuracy Frequency Requirements	Precision (RPD) Control Limits		Precision Frequency Requirements
SVOCs	SW-846 Method 8270C	IDW	Surrogates Phenol-d5 2-Fluorophenol 2,4,6-Tribromophenol Nitrobenzene-d5 2-Fluorobiphenyl Terphenyl-d14	% Rec. 24-123 21-127 14-156 27-124 27-127 29-157	Surrogates: All samples, standards, QC samples			
			Matrix Spikes Phenol n-Nitroso-di-n-propyl-amine 2-Chlorophenol 4-Chloro-3-methylphenol Acenaphthene 4-Nitrophenol Pentachlorophenol Pyrene 2,4-Dinitrotoluene	 22-115 34-122 29-114 36-121 32-122 13-136 17-136 25-139 13-130	Matrix Spikes: One per 20	MS/MSDs Phenol n-Nitroso-di-n-propyl-amine 2-Chlorophenol 4-Chloro-3-methylphenol Acenaphthene 4-Nitrophenol Pentachlorophenol Pyrene 2,4-Dinitrotoluene	RPD 28 27 26 22 30 34 23 33 33	MS/MSDs: One per 20
Pesticides	SW-846 Method 8081A	IDW	Surrogates Decachlorobiphenyl Tetrachloro-m-xylene	% Rec. 27-158 35-145	Surrogates: All samples, standards, QC samples			
			Matrix Spikes gamma-BHC Heptachlor Aldrin Dieldrin Endrin 4,4'-DDT	 42-157 46-157 46-158 43-158 55-158 37-158	Matrix Spikes: One per 20	MS/MSDs gamma-BHC Heptachlor Aldrin Dieldrin Endrin 4,4'-DDT	RPD 31 30 32 31 35 35	MS/MSDs: One per 20

Table 4
Data Quality Objectives: Precision and Accuracy
First Avenue Properties - Supplemental Soil Investigation QAPP

Parameter	Method	Matrix	Accuracy Control Limits	Accuracy Frequency Requirements	Precision (RPD) Control Limits	Precision Frequency Requirements
GRO	SW-846 Method 8015B	Soil	Surrogates — % Rec. 2-Bromo-1-chloropropane 15-143 ααα-Trifluorotoluene 42-147 Fluorobenzene 14-122 Matrix Spikes GRO (C_4-C_{12}) 14-131 GRO (C_6-C_{10}) 18-139	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20	Field Duplicates RPD 50 MS/MSDs — RPD GRO (C_4-C_{12}) 18 GRO (C_6-C_{10}) 15	Field Duplicates: One per 20 MS/MSDs: One per 20
Metals	SW-846 Methods 6010B/7000 Series	Soil/IDW	Matrix Spikes 75-125% recovery	Matrix Spikes: One per 20 per matrix type	Matrix Duplicates RPD 20	Matrix Duplicates: One per 20 per matrix type
TCLP VOCs (STARS/TAGM)	SW-846 Methods 1311/ 8260B	Soil	Surrogates — % Rec. 1,2-Dichloroethane-d4 68-124 4-Bromofluorobenzene 75-127 Dibromofluoromethane 81-118 Toluene-d8 85-119 Matrix Spike Compounds 1,1-Dichloroethene 72-134 Trichloroethene 77-132 Benzene 61-138 Toluene 55-147 Chlorobenzene 83-124	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	MS/MSDs — RPD 1,1-Dichloroethene 17 Trichloroethene 13 Benzene 11 Toluene 12 Chlorobenzene 12	MS/MSDs: One per 20 per matrix type

Table 4
Data Quality Objectives: Precision and Accuracy
First Avenue Properties - Supplemental Soil Investigation QAPP

Parameter	Method	Matrix	Accuracy Control Limits		Accuracy Frequency Requirements	Precision (RPD) Control Limits		Precision Frequency Requirements
TCLP VOCs (RCRA)	SW-846 Methods 1311/8260B	IDW	Surrogates	% Rec.	Surrogates: All samples, standards, QC samples			
			1,2-Dichloroethane-d4	68-124				
			4-Bromofluorobenzene	75-127				
			Dibromofluoromethane	81-118				
			Toluene-d8	85-119				
			Matrix Spike Compounds		Matrix Spikes: One per 20 per matrix type	MS/MSDs	RPD	MS/MSDs: One per 20 per matrix type
			1,1-Dichloroethene	72-134		1,1-Dichloroethene	17	
			1,2-Dichloroethane	67-138		1,2-Dichloroethane	12	
			2-Butanone	41-141		2-Butanone	29	
			Chloroform	76-128		Chloroform	12	
			Carbon Tetrachloride	69-143		Carbon Tetrachloride	17	
			Benzene	61-138		Benzene	11	
			Trichloroethene	77-132		Trichloroethene	13	
			Tetrachloroethene	55-149		Tetrachloroethene	13	
			Chlorobenzene	83-124		Chlorobenzene	12	
			Vinyl chloride	63-138		Vinyl chloride	18	
			1,4-Dichlorobenzene	75-121		1,4-Dichlorobenzene	13	

Table 4
Data Quality Objectives: Precision and Accuracy
First Avenue Properties - Supplemental Soil Investigation QAPP

Parameter	Method	Matrix	Accuracy Control Limits		Accuracy Frequency Requirements	Precision (RPD) Control Limits		Precision Frequency Requirements
TCLP PAHs (STARS/TAGM)	SW-846 Methods 1311/ 8270C	Soil	Surrogates	% Rec.	Surrogates: All samples, standards, QC samples			
			Nitrobenzene-d5	42-127				
			2-Fluorobiphenyl	38-131				
			Terphenyl-d14	22-153				
			Matrix Spikes		Matrix Spikes: One per 20 per matrix type	MS/MSDs	RPD	MS/MSDs: One per 20 per matrix type
			Naphthalene	47-116		Naphthalene	16	
			Acenaphthene	51-116		Acenaphthene	15	
			Fluorene	47-129		Fluorene	16	
			Fluoranthene	54-125		Fluoranthene	18	
			Pyrene	53-124		Pyrene	17	
			Phenanthrene	52-119		Phenanthrene	16	
			Anthracene	51-122		Anthracene	17	
			Benzo(a)anthracene	55-121		Benzo(a)anthracene	16	
			Chrysene	53-119		Chrysene	16	
			Benzo(b)fluoranthene	52-133		Benzo(b)fluoranthene	25	
			Benzo(k)fluoranthene	47-123		Benzo(k)fluoranthene	24	
			Benzo(a)pyrene	52-122		Benzo(a)pyrene	17	
			Indeno(1,2,3-cd)pyrene	42-134		Indeno(1,2,3-cd)pyrene	25	
			Dibenzo(a,h)anthracene	51-135		Dibenzo(a,h)anthracene	20	
			Benzo(g,h,i)perylene	49-128		Benzo(g,h,i)perylene	24	

Table 4
Data Quality Objectives: Precision and Accuracy
First Avenue Properties - Supplemental Soil Investigation QAPP

Parameter	Method	Matrix	Accuracy Control Limits		Accuracy Frequency Requirements	Precision (RPD) Control Limits		Precision Frequency Requirements
TCLP SVOCs (RCRA)	SW-846 Methods 1311/8270C	IDW	Surrogates	% Rec.	Surrogates: All samples, standards, QC samples			
			Phenol-d5	10-93				
			2-Fluorophenol	10-112				
			2,4,6-Tribromophenol	37-159				
			Nitrobenzene-d5	42-127				
			2-Fluorobiphenyl	38-131				
			Terphenyl-d14	22-153				
			Matrix Spikes		Matrix Spikes: One per 20 per matrix type	MS/MSDs	RPD	MS/MSDs: One per 20 per matrix type
			Hexachloroethane	41-120		Hexachloroethane	19	
			Nitrobenzene	52-107		Nitrobenzene	17	
			Hexachlorobutadiene	46-128		Hexachlorobutadiene	18	
			2,4,6-Trichlorophenol	45-129		2,4,6-Trichlorophenol	15	
			2,4,5-Trichlorophenol	40-126		2,4,5-Trichlorophenol	16	
			2,4-Dinitrotoluene	52-114		2,4-Dinitrotoluene	17	
			Hexachlorobenzene	54-119		Hexachlorobenzene	18	
			Pentachlorophenol	33-139		Pentachlorophenol	19	
			Pyridine	25-97		Pyridine	27	
			2-Methylphenol	24-118		2-Methylphenol	15	
			3&4-Methylphenol	32-120		3&4-Methylphenol	16	
TCLP Pesticides	SW-846 Methods 1311/8081A	IDW	Surrogates	% Rec.	Surrogates: All samples, standards, QC samples			
			Decachlorobiphenyl	22-147				
			Tetrachloro-m-xylene	48-136				
			Matrix Spikes		Matrix Spikes: One per 20 per matrix type	MS/MSDs	RPD	MS/MSDs: One per 20 per matrix type
			gamma-BHC	55-144		gamma-BHC	35	
			Heptachlor	31-164		Heptachlor	35	
			Heptachlor epoxide	46-158		Heptachlor epoxide	28	
			Endrin	73-156		Endrin	34	
			Methoxychlor	55-166		Methoxychlor	35	
			Technical Chlordane			Chlordane		
			Toxaphene			Toxaphene		

Table 4
Data Quality Objectives: Precision and Accuracy
First Avenue Properties - Supplemental Soil Investigation QAPP

Parameter	Method	Matrix	Accuracy Control Limits	Accuracy Frequency Requirements	Precision (RPD) Control Limits	Precision Frequency Requirements
TCLP Herbicides	SW-846 Methods 1311/8151A	IDW	Surrogates — % Rec. 2,4-DCAA 57-158 Matrix Spikes 2,4-D 48-123 2,4,5-TP 54-143	Surrogates: All samples, standards, QC samples Matrix Spikes: One per 20 per matrix type	MS/MSDs — RPD 2,4-D 21 2,4,5-TP 20	MS/MSDs: One per 20 per matrix type
TCLP Metals	SW-846 Methods 1311/ 6010B/7000 Series	Soil/IDW	Matrix Spikes 75-125% recovery	Matrix Spikes: One per 20 per matrix type	Matrix Duplicates RPD 20	Matrix Duplicates: One per 20 per matrix type
Ignitability	SW-846 Method 1010	Soil/IDW	Not Applicable	Not Applicable	Matrix Duplicates RPD 20	Matrix Duplicates: One per 20 per matrix type
Corrosivity	SW-846 Method 9045C	Soil/IDW	Not Applicable	Not Applicable	Matrix Duplicates RPD 5	Matrix Duplicates: One per 20 per matrix type
Reactive cyanide	SW-846 Chapter 7, Section 7.3.3	Soil/IDW	Not Applicable	Not Applicable	Matrix Duplicates RPD 20	Matrix Duplicates: One per 20 per matrix type
Reactive sulfide	SW-846 Chapter 7, Section 7.3.4	Soil/IDW	Not Applicable	Not Applicable	Matrix Duplicates RPD 20	Matrix Duplicates: One per 20 per matrix type

Recovery criteria for laboratory control samples must be at least as stringent as MS/MSD criteria.
Laboratory control limits are periodically updated. The latest control limits will be utilized at the time of sample analysis.

4.0 SAMPLING PLAN

The Supplemental Soil Investigation program consists exclusively of soil and waste characterization sampling elements. The soil borings will also be drilled for the purposes of a geotechnical investigation performed in parallel with the environmental component.

4.1 Soil Sampling

Each split spoon sample will be screened using an organic vapor monitor (OVM) to detect possible organic vapors. Organic vapor screening will be performed by opening the split spoon, making a small slice in the soil column with a clean knife or sampling tool, inserting the OVM probe and pushing the slice closed, and monitoring the soil for approximately 5 to 10 seconds. This procedure will be repeated at intervals along the split spoon soil column at the field geologist's discretion.

The split spoons will be examined for staining, discoloration, odors, and debris indicative of contamination (ash, coal fragments, wood chips, cinders, petroleum staining, etc.) One sample will be collected from each split spoon, from the six-inch interval most likely to be contaminated, based on OVM readings, discoloration, staining, and the field geologist's judgment. For the specific borings and general depth intervals, refer to tables 1,2, and 3 in the Work Plan. Note that due to sample recovery or field conditions, sample intervals other than six inches may be necessary to collect sufficient sample.

The samples will be collected by cutting the soil in two places with a decontaminated steel, stainless steel, or aluminum trowel, spoon, or knife and homogenized in a decontaminated stainless steel pan before being placed in the sample bottles (refer to Table 2). VOC and GRO samples will go directly into the sample containers without homogenization. Samplers will wear phthalate-free gloves such as nitrile (no latex will be used) and will avoid contact of the gloves with the sample. Only clean metal instruments will be allowed to touch the sample. If there is no recovery, then the sample from this depth will be skipped, and drilling will progress to the next sampling interval.

4.2 QC Sample Collection

QC samples will include equipment blanks, field duplicates and MS/MSDs.

Equipment blanks will consist of distilled water and will be used to check for potential contamination of the equipment which may cause sample contamination. Equipment blanks will be collected by routing the distilled water through the sampling equipment prior to sample collection. Equipment blanks will be submitted to the laboratory at a frequency of one per 20 samples per type of equipment being used per parameter, with the exception of TCLP parameters; equipment blanks will not be submitted for the TCLP parameters.

Field duplicates are an additional aliquot of the same sample submitted for the same parameters as the original sample. Field duplicates will be used to assess the sampling and analytical reproducibility. Field duplicates will be collected by alternately filling sample bottles from the source being sampled. Field duplicates will be submitted at a frequency of one per 20 samples for all matrices and all parameters, with the exception of TCLP parameters; field duplicates will not be submitted for the TCLP parameters.

MSs and MSDs are two additional aliquots of the same sample submitted for the same parameters as the original sample. However, the additional aliquots are spiked with the compounds of concern. Matrix spikes provide information about the effect of the sample matrix on the measurement methodology. MS/MSDs will be submitted at a frequency of one per 20 investigative samples for organic parameters. MSs will be submitted at a frequency of one per 20 investigative samples for inorganic parameters.

Refer to Table 5 for a summary of QC sample preservation and container requirements.

4.3 Sample Preservation, Containerization and Holding Times

The analytical laboratory will supply the sample containers for the chemical samples. These containers will be cleaned by the manufacturer to meet or exceed all analyte specifications established in the latest U.S. EPA's *Specifications and Guidance for Contaminant-Free Sample Containers*. Certificates of analysis are provided with each bottle lot and maintained on file to document conformance to EPA specifications.

4.4 Equipment Decontamination

4.4.1 Sampling Equipment

Re-usable Teflon, stainless steel, and aluminum sampling equipment shall be cleaned <u>between each use</u> in the following manner:

- Wash/scrub with a biodegradable degreaser ("Simple Green") if there is oily residue on equipment surface
- Tap water rinse
- Wash and scrub with Alconox and water mixture
- Tap water rinse
- Hexane rinse (optional, only if required to remove heavy petroleum coating)
- Distilled/deionized water rinse
- Air dry

Cleaned equipment shall be wrapped in aluminum foil if not used immediately after air-drying.

5.0 DOCUMENTATION AND CHAIN-OF-CUSTODY

5.1 Sample Collection Documentation

5.1.1 Field Notes

Field team members will keep a field logbook to document all field activities. Field logbooks will provide the means of recording the chronology of data collection activities performed during the investigation. As such, entries will be described in as much detail as possible so that a particular situation could be reconstructed without reliance on memory.

The logbook will be a bound notebook with water-resistant pages. Logbook entries will be dated, legible, and contain accurate and inclusive documentation of the activity. The title page of each logbook will contain the following:

- Person to whom the logbook is assigned,
- The logbook number,
- Project name and number,
- Site name and location,
- Project start date, and
- End date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, and names of all sampling team members present will be entered. Each page of the logbook will be signed and dated by the person making the entry. All entries will be made in permanent ink, signed, and dated and no erasures or obliterations will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark which is signed and dated by the sampler. The correction shall be written adjacent to the error.

Field activities will be fully documented. Information included in the logbook will include, but may not be limited to,

- Chronology of activities, including entry and exit times,
- Names of all people involved in sampling activities,
- Level of personal protection used,
- Any changes made to planned protocol,
- Names of visitors to the site during sampling and reason for their visit,
- Sample location and identification,
- Changes in weather conditions,
- Dates (month/day/year) and times (military) of sample collection,
- Measurement equipment identification (model/manufacturer) and calibration information,
- Sample collection methods and equipment,
- Sample depths,
- Whether grab or composite sample collected,

- How sample composited, if applicable,
- Sample description (color, odor, texture, etc.)
- Sample identification code.
- Tests or analyses to be performed,
- Sample preservation and storage conditions,
- Equipment decontamination procedures,
- QC sample collection,
- Unusual observations,
- Record of photographs,
- Sketches or diagrams, and
- Signature of person recording the information

Field logbooks will be reviewed on a daily basis by the Field Team Leader. Logbooks will be supported by standardized forms.

5.1.2 Chain-of-Custody Records

Sample custody is discussed in detail in Section 5.2 of this QAPP. Chain-of-custody records are initiated by the samplers in the field. The field portion of the custody documentation should include: (1) the project name; (2) signatures of samplers; (3) the sample number, date and time of collection, and whether the sample is grab or composite; (4) signatures of individuals involved in sampling; and (5) if applicable, air bill or other shipping number. Sample receipt and log-in procedures at the laboratory are described in Section 5.2.2 of this QAPP.

On a daily basis, samples will be transferred to the custody of the respective laboratories, via third-party commercial carriers or via laboratory courier service. Sample packaging and shipping procedures, and field chain-of-custody procedures are described in Section 5.2.1 of this QAPP.

5.1.3 Sample Labeling

Immediately upon collection, each sample will be labeled with a pre-printed adhesive label, which includes the date and time of collection, sampler's initials, tests to be performed, preservative (if applicable), and a unique identifier. The following identification scheme will be used:

A. The sample ID number will include the soil sampling, soil boring, or monitoring well location, along with the sample depth, sample interval, and the depth interval at which it was collected.

<u>Example:</u>

Sample "KB-22, 4-6', 12"-18" " indicates the sample was taken at the Kips Bay boring location B-22, in the 4 to 6-foot split spoon depth below grade, from the 6-inch interval in the spoon beginning at 12 inches and ending at 18 inches (out of a potential 24 inches per spoon). (Use OB for 708, PL for Parking Lot and WS for Waterside Units.)

Duplicate samples will be labeled as blind duplicates by giving them sample numbers indistinguishable from a normal sample.

Blanks should be spelled out and identify the associated matrix, e.g. Field Blank, Soil

MS/MSDs will be noted in the Comments column of the COC.

B. The job number will be the number assigned to the particular site.

Example: 28410-KB03-2210T

C. The analysis required will be indicated for each sample.

Example: SVOC

D. Date taken will be the date the sample was collected, using the format: MM-DD-YY.

Example: 3-22-01

E. Time will be the time the sample was collected, using military time.

Example: 1335

F. The sampler's name will be printed in the "Sampled By" section.

G. Other information relevant to the sample.

Example: Field Blank

An example sample label is presented below:

Job No:	28410-KB03-2210T
Client:	TRC
Sample No:	"KB-22, 4-6', 12"-18"
Matrix:	Soil
Date Taken:	3/22/01
Time Taken:	14:30
Sampler:	M. Burke
Analysis:	SVOC

Job No. ______________________________
Client: ______________________________
Sample Number ______________________________
Date ______________ Sample Time ______________
Sample Matrix ______________________________
Grab or Composite (explain) ______________________________
Preservatives ______________________________
Analyses ______________________________
Sampler Signature ______________________________

This sample label contains the authoritative information for the sample. Inconsistencies with other documents will be settled in favor of the vial or container label unless otherwise corrected in writing from the field personnel collecting samples or the TRC Project QA Officer.

5.2 Sample Custody

Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files.

A sample or evidence file is considered to be under a person's custody if

- the item is in the actual possession of a person;
- the item is in the view of the person after being in actual possession of the person;
- the item was in the actual physical possession of the person but is locked up to prevent tampering;
- the item is in a designated and identified secure area.

5.2.1 Field Custody Procedures

Samples will be collected following the sampling procedures documented in Section 4.1 of this QAPP. Documentation of sample collection is described in Section 5.1 of this QAPP. Sample chain-of-custody and packaging procedures are summarized below. These procedures will ensure that the samples will arrive at the laboratory with the chain-of-custody intact.

- The field sampler is personally responsible for the care and custody of the samples until they are transferred or dispatched properly. Field procedures have been designed such that as few people as possible will handle the samples.

- All bottles will be identified by the use of sample labels with sample numbers, sampling locations, date/time of collection, and type of analysis. The sample numbering system is presented in Section 5.1.3 of this QAPP.

- Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample label because the pen would not function in wet weather.

- Samples will be accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage location.

- All shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler and placed in the project files.

- Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. The custody seals will be attached to the front right and back left of the cooler and covered with clear plastic tape after being signed by field personnel. The cooler will be strapped shut with strapping tape in at least two locations.

- If the samples are sent by common carrier, the air bill will be used. Air bills will be retained as part of the permanent documentation. Commercial carriers are not required to sign off on the custody forms since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact.

- Samples remain in the custody of the sampler until transfer of custody is completed. This consists of delivery of samples to the laboratory sample custodian, and signature of the laboratory sample custodian on chain-of-custody document as receiving the samples and signature of sampler as relinquishing samples.

5.2.2 Laboratory Custody Procedures

Samples will be received and logged in by a designated sample custodian or his/her designee. Upon sample receipt, the sample custodian will

- Examine the shipping containers to verify that the custody tape is intact,

- Examine all sample containers for damage,

- Determine if the temperature required for the requested testing program has been maintained during shipment and document the temperature on the chain-of-custody records,

- Compare samples received against those listed on the chain-of-custody,

- Verify that sample holding times have not been exceeded,

- Examine all shipping records for accuracy and completeness,

- Determine sample pH (if applicable) and record on chain-of-custody forms,

- Sign and date the chain-of-custody immediately (if shipment is accepted) and attach the air bill,

- Note any problems associated with the coolers and/or samples on the cooler receipt form and notify the Laboratory Project Manager, who will be responsible for contacting the TRC Project QA Officer,

- Attach laboratory sample container labels with unique laboratory identification and test, and

- Place the samples in the proper laboratory storage.

Following receipt, samples will be logged in according to the following procedure:

- The samples will be entered into the laboratory tracking system. At a minimum, the following information will be entered: project name or identification, unique sample numbers (both client and internal laboratory), type of sample, required tests, date and time of laboratory receipt of samples, and field ID provided by field personnel.

- The Laboratory Project Manager will be notified of sample arrival.

- The completed chain-of-custody, air bills, and any additional documentation will be placed in the final evidence file.

6.0 CALIBRATION PROCEDURES

6.1 Field Instruments

Field instruments will be calibrated according to the manufacturer's specifications. All calibration procedures performed will be documented in the field logbook and will include the date/time of calibration, name of person performing the calibration, reference standard used, temperature at which the readings were taken, and the readings.

6.2 Laboratory Instruments

Calibration procedures for a specific laboratory instrument will consist of initial calibrations, initial calibration verifications, and/or continuing calibration verification. Detailed descriptions of the calibration procedures for a specific laboratory instrument are included in the laboratory's standard operating procedures (SOPs), which describe the calibration procedures, their frequency, acceptance criteria, and the conditions that will require recalibration. These procedures are as required in the respective analytical methodologies (summarized in Table 2 of this QAPP).

7.0 SAMPLE PREPARATION AND ANALYTICAL PROCEDURES

There are no field analyses associated with the Supplemental Soil Investigation. Analyses of all soil samples will be performed by Accutest Labs in Dayton, New Jersey. Table 2 summarizes the analytical methods to be used during this investigation.

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

Appropriate QC measures will be used to ensure the generation of reliable data from sampling and analysis activities. Proper collection and organization of accurate information followed by clear and concise reporting of the data is a primary goal in this project. Complete data packages suitable for data validation to support the generation of a Data Usability Summary Report (DUSR) according to NYSDEC requirements will be provided by the analytical laboratory.

8.1 Data Evaluation/Validation

8.1.1 Field Data Evaluation

Measurements and sample collection information will be transcribed directly into the field logbook or onto standardized forms. If errors are made, results will be legibly crossed out, initialed and dated by the person recording the data, and corrected in a space adjacent to the original (erroneous) entry. Daily reviews of the field records by the Field Team Leader will ensure that:

- Logbooks and standardized forms have been filled out completely and that the information recorded accurately reflects the activities that were performed.
- Records are legible and in accordance with good record keeping procedures, i.e., entries are signed and dated, data are not obliterated, changes are initialed, dated, and explained.
- Sample collection, handling, preservation, and storage procedures were conducted in accordance with the protocols described in the QAPP, and that any deviations were documented and approved by the appropriate personnel.

8.1.2 Analytical Data Validation

TRC will be responsible for performing an independent validation of the analytical data. Project-specific procedures will be used to validate analytical laboratory data. The basis for the validation will be the USEPA CLP National Functional Guidelines for Organic Data Review (October 1999) and the USEPA CLP National Functional Guidelines for Inorganic Data Review (February 1994), modified to accommodate the criteria in the analytical methods used in this program, and Region II Standard Operating Procedures (SOPs) for CLP Organic Data review (Revision 11, June 1996) and Evaluation of Metals for the CLP Program (Revision 11, January 1992). Tables 2, 4 and 5 highlight the QC criteria and holding time requirements for all analyses conducted under this program. These criteria will be used to evaluate and qualify the data during validation.

TRC will validate an appropriate number of samples collected for the purpose of characterizing the subsurface and/or delineating impacted areas. One hundred percent of the analytical data will be validated where endpoint delineation samples occur, or where a sample documents no further action, as in the case of meeting cleanup criteria or action levels. Samples collected for waste classification will not be validated. Validation will include all technical holding times, as well as QC sample results (blanks, surrogate spikes, laboratory duplicates, MS/MSDs, and LCSs), tunes, internal standards, calibrations, target compound identification, and results calculations.

The overall completeness of the data package will also be evaluated by the data validator. Completeness checks will be administered on all data to determine whether full data deliverables were provided. The reviewer will determine whether all required items are present and request copies of missing deliverables.

Upon completion of the validation, a report will be prepared. This report will summarize the samples reviewed, elements reviewed, any nonconformances with the established criteria, and validation actions. Data qualifiers will be consistent with EPA National Functional Guidelines. This report will be in a format consistent with NYSDEC's Data Usability Summary Report (DUSR),

8.2 Identification and Treatment of Outliers

Any data point which deviates markedly from others in its set of measurements will be investigated; however, the suspected outlier will be recorded and retained in the data set. One or both of the following tests will be used to identify outliers.

Dixon's test for extreme observations is an easily computed procedure for determining whether a single very large or very small value is consistent with the remaining data. The one-tailed t-test for difference may also be used in this case. It should be noted that these tests are designed for testing a single value. If more than one outlier is suspected in the same data set, other statistical sources may be consulted and the most appropriate test of hypothesis will be used and documented, if warranted.

Since an outlier may result from unique circumstances at the time of sample analysis or data collection, those persons involved in the analysis and data reduction will be consulted. This may provide an experimental reason for the outlier. Further statistical analysis may be performed with and without the outlier to determine its effect on the conclusions. In many cases, two data sets may be reported, one including, and one excluding the outlier.

In summary, every effort will be made to include the outlying values in the reported data. If the value is rejected, it will be identified as an outlier, reported with its data set and its omission noted.

9.0 INTERNAL QUALITY CONTROL

The subcontracting laboratory Quality Assurance Project Plan will identify the supplemental internal analytical quality control procedures to be used. At a minimum, this will include:

- Matrix spike and/or matrix spike duplicate samples
- Matrix duplicate analyses
- Laboratory control spike samples
- Instrument calibrations
- Instrument tunes for SW-846 8260B and 8270C analyses
- Method and/or instrument blanks
- Surrogate spikes for organic analyses
- Internal standard spikes for SW-846 8260B and 8270C analyses
- Detection limit determination and confirmation by analysis of low-level calibration standard

Field quality control samples will include:

- Equipment blanks described in Table 5
- Field duplicate samples will be collected as outlined in Table 5
- MS/MSDs described in Section 4.2

10.0 CORRECTIVE ACTION

The entire sampling program will be under the direction of TRC's Project QA officer. The emphasis in this program is on preventing problems by identifying potential errors, discrepancies, and gaps in the data-collection-laboratory-analysis-interpretation process. Any problems identified will be promptly resolved. Likewise, follow-up corrective action is always an option in the event that preventative corrective actions are not totally effective.

The acceptance limits for the sampling and analyses to be conducted in this program will be those stated in the method or defined by other means in the QAPP. Corrective actions are likely to be immediate in nature and most often will be implemented by the contracted laboratory analyst or the TRC Program Manager. The corrective action will usually involve recalculation, reanalysis, or repeating a sample run.

10.1 Immediate Corrective Action

Corrective action in the field may be needed when the sample network is changed (i.e., more/less samples, sampling locations other than those specified in the QAPP), or when sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. The field team may identify the need for corrective action. The Field Team Leader will approve the corrective action and notify the TRC Program Manager. The TRC Program Manager will approve the corrective measure. The Field Team Leader will ensure that the corrective measure is implemented by the field team.

Corrective actions will be implemented and documented in the field record book. Documentation will include:

- A description of the circumstances that initiated the corrective action,
- The action taken in response,
- The final resolution, and
- Any necessary approvals.

No staff member will initiate corrective action without prior communication of findings through the proper channels.

Corrective action in the laboratory may occur prior to, during, and after initial analyses. A number of conditions such as broken sample containers, omissions or discrepancies with chain-of-custody documentation, low/high pH readings, and potentially high concentration samples may be identified during sample log-in or just prior to analysis. Following consultation with laboratory analysts and Laboratory Section Leaders, it may be necessary for the Laboratory QA Manager to approve the implementation of corrective action. The laboratory SOPs specify some conditions during or after analysis that may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples, additional sample extract cleanup, automatic reinjection/reanalysis when certain QC criteria are not met, loss of sample through breakage or spillage, etc.

The analyst may identify the need for corrective action. The Laboratory Section Leader, in consultation with the staff, will approve the required corrective action to be implemented by the laboratory staff. The Laboratory QA Manager will ensure implementation and documentation of the corrective action. If the nonconformance causes project objectives not to be achieved, the TRC Project QA Officer will be notified. The TRC Project QA Officer will notify the TRC Program Manager, who in turn will contact all levels of project management for concurrence with the proposed corrective action.

These corrective actions are performed prior to release of the data from the laboratory. The corrective action will be documented in both the laboratory's corrective action files, and the narrative data report sent from the laboratory to the TRC Program Manager. If the corrective action does not rectify the situation, the laboratory will contact the TRC Program Manager, who will determine the action to be taken and inform the appropriate personnel.

If potential problems are not solved as an immediate corrective action, the contractor will apply formalized long-term corrective action if necessary.

ATTACHMENT 1

STARS AND TAGM GUIDANCE

New York State Department of Environmental Conservation
Division of Environmental Remediation
MEMORANDUM

TO: Bureau Directors, Regional Spill Engineers, Regional Hazardous Waste Remediation Engineers, Section Chiefs
FROM: Michael J O'Toole, Jr., Director
SUBJECT: Determination of Soil Cleanup Levels
DATE: DEC 20 2000

Since the Divisions of Hazardous Waste Remediation and Spills Management were combined, efforts have been underway to consolidate similar activities. One such effort is the determination of soil cleanup. Existing documents included TAGM 4046: Determination of Soil Cleanup Objectives and Levels, and STARS Memo #1 : Petroleum-Contaminated Soil Guidance Policy. TAGM 4046 was designed as guidance for the determination of soil cleanup levels at Inactive Hazardous Waste Sites. STARS #1 was designed to determine when petroleum contaminated soil can be released from regulation but has been used to determine soil cleanup levels. While a direct comparison of the guidance values is not possible for the contaminants included in both documents, (one uses total concentration while the other is leachate based), the values are not the same. This has lead to much confusion as well as some criticism of not being consistent across the program. A revised guidance document for the determination of soil cleanup at all contaminated sites is being developed. However, until that document is finalized and completes the process for approval of Departmental Policy, TAGM 4046 is to be used for the determination of soil cleanup levels at all sites that are under this Divisions' purview. The tables contained in STARS #1 will continue to be used for its intended purpose: "To provide direction on the handling, disposal, and/or reuse of nonhazardous petroleum contaminated soils."

TAGM 4046 contains soil cleanup objectives for volatile compounds, semi-volatile compounds, pesticides/PCBs and metals using criteria for the protection of groundwater and human health and the environment. There are some contaminants that are included in STARS #1 that are not listed in TAGM 4046. Soil cleanup objectives for those contaminants have been calculated and are attached and should be considered part of TAGM 4046. In general, the soil cleanup objectives for individual contaminants listed in TAGM 4046 should be used. However, TAGM 4046 does contain maximum values for classes of contaminants (e.g. total Semi-VOCs ≤ 500 ppm) that can be used when many specific contaminants from one class of contaminant are present with no single contaminant predominating.

It is recognized that petroleum spill sites do not go though the same process as inactive hazardous waste sites. This directive does not change the STARS #1 process or the process of determining the appropriate remedy at a petroleum spill site. The intent is only to substitute the soil cleanup objectives contained in TAGM 4046 for the numerical values in the tables in STARS #1. The primary objective is to achieve those values. However, if it is not feasible to achieve the objectives, further evaluation is conducted to determine if a higher value may be used for the specific spill site.

This directive is effective immediately. If there are any questions relative to the use of TAGM 4046 soil cleanup objectives for petroleum sites, please contact Jim Harrington at 518-

Appendix A
Table 1
Recommended Soil Cleanup objectives for
Volatile Organic Compounds
1998

..aminant	CAS Registry Number	Partition coefficient Koc	Groundwater Standards/ Criteria ug/l or ppb	Groundwater Standards / Criteria Designation	Soil Cleanup objectives to Protect GW Quality (ppm)	USEPA Health Based (HEAST) Carcinogens (ppm)	USEPA Health Based (HEAST) Systemic Toxicants (ppm)	Rec. soil Cleanup Objective (ppm)	Detection Limit	Notations
..tyl-Benzene	104-58-8	3523	5	P	17.62	N/A	N/A	18		
..utyl-Benzene	135-98-8	4982	5	P	24.91	N/A	N/A	25		
..opylbenzene	98-82-8	948	5	P	4.74	N/A	3100	5		
..propyltoluene	99-87-6	2,114	5	P	10.57	N/A	N/A	11		
..yl-Tert-Butyl-Ether (MTBE)	1634-04-4	12	10	G	0.12	N/A		0.12		B
..opylbenzene	103-65-1	2800	5	P	14.00	N/A	N/A	14		
..-Trimethylbenzene	95-63-6	2590	5	P	12.95	N/A	N/A	13		
..5 - Trimethylbenzene	108-67-8	661	5	P	3.31	N/A	N/A	3.3		

..Cleanup objective reflects changes to groundwater standards in June 1998 version of TOGS 1.1.1

..A groundwater standard is under review and has not been finalized yet 10 ppb was used to reflect the guidance value published in the April 2000 amendment to TOGS 1.1.1

.. - Not available

..L - Method detection limit

HWR-94-4046
January 24, 1994
(REVISED)

New York State Department of Environmental Conservation

MEMORANDUM

TO: Regional Haz. Waste Remediation Engineers, Bureau Dirs. & Section Chiefs
FROM: Michael J. O'Toole, Jr., Director, Div. of Hazardous Waste Remediation
SUBJECT: DIVISION TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM: DETERMINATION OF SOIL CLEANUP OBJECTIVES AND CLEANUP LEVELS

DATE: JAN 24 1994

The cleanup goal of the Department is to restore inactive hazardous waste sites to predisposal conditions, to the extent feasible and authorized by law. However, it is recognized that restoration to predisposal conditions will not always be feasible.

1. INTRODUCTION:

This TAGM provides a basis and procedure to determine soil cleanup levels at individual Federal Superfund, State Superfund, 1986 EQBA Title 3 and Responsible Party (RP) sites, when the Director of the DHWR determines that cleanup of a site to predisposal conditions is not possible or feasible.

The process starts with development of soil cleanup objectives by the Technology Section for the contaminants identified by the Project Managers. The Technology Section uses the procedure described in this TAGM to develop soil cleanup objectives. Attainment of these generic soil cleanup objectives will, at a minimum, eliminate all significant threats to human health and/or the environment posed by the inactive hazardous waste site. Project Managers should use these cleanup objectives in selecting alternatives in the Feasibility Study (FS). Based on the proposed selected remedial technology (outcome of FS), final site specific soil cleanup levels are established in the Record of Decision (ROD) for these sites.

It should be noted that even after soil cleanup levels are established in the ROD, these levels may prove to be unattainable when remedial construction begins. In that event, alternative remedial actions or institutional controls may be necessary to protect the environment.

2. BASIS FOR SOIL CLEANUP OBJECTIVES:

The following alternative bases are used to determine soil cleanup objectives:

(a) Human health based levels that correspond to excess lifetime cancer risks of one in a million for Class A[1] and B[2] carcinogens, or one in 100,000 for Class C[3] carcinogens. These levels are contained in USEPA's Health Effects Assessment Summary Tables (HEASTs) which are compiled and updated quarterly by the NYSDEC's Division of Hazardous Substances Regulation;

(b) Human health based levels for systemic toxicants, calculated from Reference Doses (RfDs). RfDs are an estimate of the daily exposure an individual (including sensitive individuals) can experience without appreciable risk of health effects during a lifetime. An average scenario of exposure in which children ages one to six (who exhibit the greatest tendency to ingest soil) is assumed. An intake rate of 0.2 gram/day for a five-year exposure period for a 16-kg child is assumed. These levels are contained in USEPA's Health Effects Assessment Summary Tables (HEASTs) which are compiled and updated quarterly by the NYSDEC's Division of Hazardous Substances Regulation;

(c) Environmental concentrations which are protective of groundwater/drinking water quality; based on promulgated or proposed New York State Standards;

(d) Background values for contaminants; and

(e) Detection limits.

A recommendation on the appropriate cleanup objective is based on the criterion that produces the most stringent cleanup level using criteria a, b, and c for organic chemicals, and criteria a, b, and d for heavy metals. If criteria a and/or b are below criterion d for a contaminant, its background value should be used as the cleanup objective. However, cleanup objectives developed using this approach must be, at a minimum, above the method detection limit (MDL) and it is preferable to have the soil cleanup objectives above the Contract Required Quantitation Limit (CRQL) as defined by NYSDEC. If the cleanup objective of a compound is "non-detectable", it should mean that it is not detected at the MDL. Efforts should be made to obtain the best MDL detection possible when selecting a laboratory and analytical protocol.

The water/soil partitioning theory is used to determine soil cleanup objectives which would be protective of groundwater/drinking water quality for its best use. This theory is conservative in nature and assumes that contaminated soil and groundwater are in direct contact. This theory is based upon the ability of organic matter in soil to adsorb organic chemicals. The approach predicts the maximum amount of contamination that may remain in soil so that leachate from the contaminated soil will not violate groundwater and/or drinking water standards.

(1) Class A are proved human carcinogens
(2) Class B are probable human carcinogens
(3) Class C are possible human carcinogens

This approach is not used for heavy metals, which do not partition appreciably into soil organic matter. For heavy metals, eastern USA or New York State soil background values may be used as soil cleanup objectives. A list of values that have been tabulated is attached. Soil background data near the site, if available, is preferable and should be used as the cleanup objective for such metals. Background samples should be free from the influences of this site and any other source of contaminants. Ideal background samples may be obtained from uncontaminated upgradient and upwind locations.

3. DETERMINATION OF SOIL CLEANUP GOALS FOR ORGANICS IN SOIL FOR PROTECTION OF WATER QUALITY

Protection of water quality from contaminated soil is a two-part problem. The first is predicting the amount of contamination that will leave the contaminated media as leachate. The second part of the problem is to determine how much of that contamination will actually contribute to a violation of groundwater standards upon reaching and dispersing into groundwater. Some of the contamination which initially leaches out of soil will be absorbed by other soil before it reaches groundwater. Some portion will be reduced through natural attenuation or other mechanism.

PART A: PARTITION THEORY MODEL

There are many test and theoretical models which are used to predict leachate quality given a known value of soil contamination. The Water-Soil Equilibrium Partition Theory is used as a basis to determine soil standard or contamination limit for protection of water quality by most of the models currently in use. It is based on the ability of organic carbon in soil to adsorb contamination. Using a water quality value which may not be exceeded in leachate and the partition coefficient method, the equilibrium concentration (Cs) will be expressed in the same units as the water standards. The following expression is used:

Allowable Soil Concentration $Cs = f \times Koc \times Cw$ . . . . (1)

Where: f = fraction of organic carbon of the natural soil medium.

Koc = partition coefficient between water and soil media. Koc can be estimated by the following equation:

$$\log Koc = 3.64 - 0.55 \log S$$

S = water solubility in ppm
Cw = appropriate water quality value from TOGS 1.1.1

Most Koc and S values are listed in the Exhibit A-1 of the USEPA Superfund Public Health Evaluation Manual (EPA/540/1-86/060). The Koc values listed in this manual should be used for the purpose. If the Koc value for a contaminant is not listed, it should be estimated using the above mentioned equation.

PART B: PROCEDURE FOR DETERMINATION OF SOIL CLEANUP OBJECTIVES

When the contaminated soil is in the unsaturated zone above the water table, many mechanisms are at work that prevent all of the contamination that would leave the contaminated soil from impacting groundwater. These mechanisms occur during transport and may work simultaneously. They include the following: (1) volatility, (2) sorption and desorption, (3) leaching and diffusion, (4) transformation and degradation, and (5) change in concentration of contaminants after reaching and/or mixing with the groundwater surface. To account for these mechanisms, a correction factor of 100 is used to establish soil cleanup objectives. This value of 100 for the correction is consistent with the logic used by EPA in its Dilution Attenuation Factor (DAF) approach for EP Toxicity and TCLP. (Federal Register/Vol. 55, No. 61, March 29, 1990/Pages 11826-27). Soil cleanup objectives are calculated by multiplying the allowable soil concentration by the correction factor. If the contaminated soil is very close (<3' - 5') to the groundwater table or in the groundwater, extreme caution should be exercised when using the correction factor of 100 (one hundred) as this may not give conservative cleanup objectives. For such situations the Technology Section should be consulted for site-specific cleanup objectives.

Soil cleanup objectives are limited to the following maximum values. These values are consistent with the approach promulgated by the States of Washington and Michigan.

1) Total VOCs $\leq$ 10 ppm.
2) Total Semi VOCs $\leq$ 500 ppm.
3) Individual Semi VOCs $\leq$ 50 ppm.
4) Total Pesticides $\leq$ 10 ppm.

One concern regarding the semi-volatile compounds is that some of these compounds are so insoluble that their Cs values are fairly large. Experience (Draft TOGS on Petroleum

Contaminated Soil Guidance) has shown that soil containing some of these insoluble substances at high concentrations can exhibit a distinct odor even though the substance will not leach from the soil. Hence any time a soil exhibits a discernible odor nuisance, it shall not be considered clean even if it has met the numerical criteria.

4. DETERMINATION OF FINAL CLEANUP LEVELS:

Recommended soil cleanup objectives should be utilized in the development of final cleanup levels through the Feasibility Study (FS) process. During the FS, various alternative remedial actions developed during the Remedial Investigation (RI) are initially screened and narrowed down to the list of potential alternative remedial actions that will be evaluated in detail. These alternative remedial actions are evaluated using the criteria discussed in TAGM 4030, Selection of Remedial Actions at Inactive Hazardous Waste Sites, revised May 15, 1990, and the preferred remedial action will be selected. After the detailed evaluation of the preferred remedial action, the final cleanup levels which can be actually achieved using the preferred remedial action must be established. Remedy selection, which will include final cleanup levels, is the subject of TAGM 4030.

Recommended soil cleanup objectives that have been calculated by the Technology Section are presented in Appendix A. These objectives are based on a soil organic carbon content of 1% (0.01) and should be adjusted for the actual organic carbon content if it is known. For determining soil organic carbon content, use attached USEPA method (Appendix B). Please contact the Technology Section, Bureau of Program Management for soil cleanup objectives not included in Appendix A.

Attachments

cc: T. Jorling
J. Lacey
M. Gerstman
A. DeBarbieri
E. Sullivan
T. Donovan
C. Sullivan
J. Eckl
R. Davies
R. Dana
C. Goddard
E. McCandless
P. Counterman
J. Davis
J. Kelleher
J. Colquhoun
D. Persson
A. Carlson
M. Birmingham
D. Johnson
B. Hogan
Regional Directors
Regional Engineers
Regional Solid and Haz. Waste Engrs.
Regional Citizen Participation Spec.

APPENDIX A

TABLE 1

Recommended soil cleanup objectives (mg/kg or ppm)

Volatile Organic Contaminants

Contaminant	Partition coefficient Koc	Groundwater Standards/ Criteria Cw ug/l or ppb.	a Allowable Soil conc. ppm. Cs	b ** Soil Cleanup objectives to Protect GW Quality (ppm)	USEPA Health Based (ppm) Carcinogens	Systemic Toxicants	CRQL (ppb)	*** Rec.soil Clnup Objct (ppm)
Acetone	2.2	50	0.0011	0.11	N/A	8,000	10	0.2
Benzene	83	0.7	0.0006	0.06	24	N/A	5	0.06
Benzoic Acid	54*	50	0.027	2.7	N/A	300,000	5	2.7
2-Butanone	4.5*	50	0.003	0.3	N/A	4,000	10	0.3
Carbon Disulfide	54*	50	0.027	2.7	N/A	8,000	5	2.7
Carbon Tetrachloride	110*	5	0.006	0.6	5.4	60	5	0.6
Chlorobenzene	330	5	0.017	1.7	N/A	2,000	5	1.7
Chloroethane	37*	50	0.019	1.9	N/A	N/A	10	1.9
Chloroform	31	7	0.003	0.30	114	800	5	0.3
Dibromochloromethane	N/A	50	N/A	N/A	N/A	N/A	5	N/A
1,2-Dichlorobenzene	1,700	4.7	0.079	7.9	N/A	N/A	330	7.9
1,3-Dichlorobenzene	310 *	5	0.0155	1.55	N/A	N/A	330	1.6
1,4-Dichlorobenzene	1,700	5	0.085	8.5	N/A	N/A	330	8.5
1,1-Dichloroethane	30	5	0.002	0.2	N/A	N/A	5	0.2
1,2-Dichloroethane	14	5	0.001	0.1	7.7	N/A	5	0.1
1,1-Dichloroethene	65	5	0.004	0.4	12	700	5	0.4
1,2-Dichloroethene(trans)	59	5	0.003	0.3	N/A	2,000	5	0.3
1,3-dichloropropane	51	5	0.003	0.3	N/A	N/A	5	0.3
Ethylbenzene	1,100	5	0.055	5.5	N/A	8,000	5	5.5
113 Freon(1,1,2 Trichloro-1,2,2 Trifluoroethane)	1,230*	5	0.060	6.0	N/A	200,000	5	6.0
Methylene chloride	21	5	0.001	0.1	93	5,000	5	0.1
4-Methyl-2-Pentanone	19*	50	0.01	1.0	N/A	N/A	10	1.0
Tetrachloroethene	277	5	0.014	1.4	14	800	5	1.4
1,1,1-Trichloroethane	152	5	0.0076	0.76	N/A	7,000	5	0.8
1,1,2,2-Tetrachloroethane	118	5	0.006	0.6	35	N/A	5	0.6
1,2,3-trichloropropane	68	5	0.0034	0.34	N/A	80	5	0.4
1,2,4-Trichlorobenzene	670 *	5	0.034	3.4	N/A	N/A	330	3.4
Toluene	300	5	0.015	1.5	N/A	20,000	5	1.5
Trichloroethene	126	5	0.007	0.70	64	N/A	5	0.7
Vinyl chloride	57	2	0.0012	0.12	N/A	N/A	10	0.2
Xylenes	240	5	0.012	1.2	N/A	200,000	___	1.2

a. Allowable Soil Concentration Cs = f x Cw x Koc

b. Soil cleanup objective = Cs x Correction Factor (CF)

N/A is not available

* Partition coefficient is calculated by using the following equation: log Koc = -0.55 log S + 3.64, where S is solubility in water in ppm. All other Koc values are experimental values.

** Correction Factor (CF) of 100 is used as per TAGM #4046

*** As per TAGM #4046, Total VOCs < 10 ppm.

Note: Soil cleanup objectives are developed for soil organic carbon content (f) of 1% , and should be adjusted for the actual soil organic carbon content if it is known.

APPENDIX A (cont.)
TABLE 2
Recommended Soil Cleanup Objectives (mg/kg or ppm)
Semi-Volatile Organic Contaminants

Contaminant	Partition coefficient Koc	Groundwater Standards/ Criteria Cw ug/l or ppb.	a Allowable Soil conc. ppm. Cs	b Soil Cleanup objectives to Protect GW Quality (ppm) **	USEPA Health Based (ppm) Carcinogens	Systemic Toxicants	CRQL (ppb)	Rec.soil Clnup Objct. (ppm)
Acenaphthene	4,600	20	0.9	90.0	N/A	5,000	330	50.0***
Acenaphthylene	2,056*	20	0.41	41.0	N/A	N/A	330	41.0
Aniline	13.8	5	0.001	0.1	123	N/A	330	0.1
Anthracene	14,000	50	7.00	700.0	N/A	20,000	330	50.0***
Benzo(a)anthracene	1,380,000	0.002	0.03	3.0	0.224	N/A	330	0.224 or MDL
Benzo(a)pyrene	5,500,000	0.002(ND)	0.110	11.0	0.0609	N/A	330	0.061 or MDL
Benzo(b)fluoranthene	550,000	0.002	0.011	1.1	N/A	N/A	330	1.1
Benzo(g,h,i)perylene	1,600,000	5	8.0	800	N/A	N/A	330	50.0***
Benzo(k)fluoranthene	550,000	0.002	0.011	1.1	N/A	N/A	330	1.1
bis(2-ethylhexyl)phthalate	8,706*	50	4.35	435.0	50	2,000	330	50.0***
Butylbenzylphthlate	2,430	50	1.215	122.0	N/A	20,000	330	50.0***
Chrysene	200,000	0.002	0.004	0.4	N/A	N/A	330	0.4
4-Chloroaniline	43 ****	5	0.0022	0.22	200	300	330	0.220 or MDL
4-Chloro-3-methylphenol	47	5	0.0024	0.24	N/A	N/A	330	0.240 or MDL
2-Chlorophenol	15*	50	0.008	0.8	N/A	400	330	0.8
Dibenzofuran	1,230*	5	0.062	6.2	N/A	N/A	330	6.2
Dibenzo(a,h)anthracene	33,000,000	50	1,650	165,000	0.0143	N/A	330	0.014 or MD
3,3'-Dichlorobenzidine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4-Dichlorophenol	380	1	0.004	0.4	N/A	200	330	0.4
2,4-Dinitrophenol	38	5	0.002	0.2	N/A	200	1,600	0.200 or MD
2,6 Dinitrotoluene	198*	5	0.01	1.0	1.03	N/A	330	1.0
Diethylphthlate	142	50	0.071	7.1	N/A	60,000	330	7.1
Dimethylphthlate	40	50	0.020	2.0	N/A	80,000	330	2.0
Di-n-butyl phthalate	162*	50	0.081	8.1	N/A	8,000	330	8.1
Di-n-octyl phthlate	2,346*	50	1.2	120.0	N/A	2,000	330	50.0***
Fluoranthene	38,000	50	19	1900.0	N/A	3,000	330	50.0***
Fluorene	7,300	50	3.5	350.0	N/A	3,000	330	50.0***
Hexachlorobenzene	3,900	0.35	0.014	1.4	0.41	60	330	0.41
Indeno(1,2,3-cd)pyrene	1,600,000	0.002	0.032	3.2	N/A	N/A	330	3.2
Isophorone	88.31*	50	0.044	4.40	1,707	20,000	330	4.40
2-methylnaphthalene	727*	50	0.364	36.4	N/A	N/A	330	36.4
2-Methylphenol	15	5	0.001	0.1	N/A	N/A	330	0.100 or MD
4-Methylphenol	17	50	0.009	0.9	N/A	4,000	330	0.9
Naphthalene	1,300	10	0.130	13.0	N/A	300	330	13.0
Nitrobenzene	36	5	0.002	0.2	N/A	40	330	0.200 or MC
2-Nitroaniline	86	5	0.0043	0.43	N/A	N/A	1,600	0.430 or MC
2-Nitrophenol	65	5	0.0033	0.33	N/A	N/A	330	0.330 or MC
4-Nitrophenol	21	5	0.001	0.1	N/A	N/A	1,600	0.100 or MC
3-Nitroaniline	93	5	0.005	0.5	N/A	N/A	1,600	0.500 or MC
Pentachlorophenol	1,022	1	0.01	1.0	N/A	2,000	1,600	1.0 or MDL
Phenanthrene	4,365*	50	2.20	220.0	N/A	N/A	330	50.0***
Phenol	27	1	0.0003	0.03	N/A	50,000	330	0.03 or MDL
Pyrene	13,295*	50	6.65	665.0	N/A	2,000	330	50.0***
2,4,5-Trichlorophenol	89*	1	0.001	0.1	N/A	8,000	330	0.1

a. Allowable Soil Concentration Cs = f x Cw x Koc
b. Soil cleanup objective = Cs x Correction Factor (CF)

N/A is not available
MDL is Method Detection Limit

* Partition coefficient is calculated by using the following equation:
log Koc = -0.55 log S + 3.64, where S is solubility in water in ppm. Other Koc values are experimental values.

** Correction Factor (CF) of 100 is used as per TAGM #4046

*** As per TAGM #4046, Total VOCs < 10 ppm., Total Semi-VOCs < 500 ppm. and Individual Semi-VOCs < 50 ppm.

**** Koc is derived from the correlation Koc = 0.63 Kow (Determining Soil Response Action Levels..... EPA/540/2-89/057). Kow is obtained from the USEPA computer database 'MAIN'.

Note: Soil cleanup objectives are developed for soil organic carbon content (f) of 1%, and should be adjusted for the actual soil organic carbon content if it is known.

APPENDIX A (cont.)

TABLE 3

Recommended soil cleanup objectives (mg/kg or ppm)

Organic Pesticides / Herbicides and PCBs

Contaminant	Partition coefficient Koc	Groundwater Standards/ Criteria Cw ug/l or ppb.	a Allowable Soil conc. ppm. Cs	b ** Soil Cleanup objectives to Protect GW Quality (ppm)	USEPA Health Based (ppm) Carcinogens	Systemic Toxicants	CRQL (ppb)	*** Rec.soil Clnup Objct (ppm)
Aldrin	96,000	ND(<0.01)	0.005	0.5	0.041	2	8	0.041
alpha - BHC	3,800	ND(<0.05)	0.002	0.2	0.111	N/A	8	0.11
beta - BHC	3,800	ND(<0.05)	0.002	0.2	3.89	N/A	8	0.2
delta - BHC	6,600	ND(<0.05)	0.003	0.3	N/A	N/A	8	0.3
Chlordane	21,305*	0.1	0.02	2.0	0.54	50	80	0.54
2,4-D	104*	4.4	0.005	0.5	N/A	800	800	0.5
4,4'-DDD	770,000*	ND(<0.01)	0.077	7.7	2.9	N/A	16	2.9
4,4'-DDE	440,000*	ND(<0.01)	0.0440	4.4	2.1	N/A	16	2.1
4,4'-DDT	243,000*	ND(<0.01)	0.025	2.5	2.1	40	16	2.1
Dibenzo-P-dioxins(PCDD) 2,3,7,8 TCDD	1709800	0.000035	0.0006	0.06	N/A	N/A	N/A	N/A
Dieldrin	10,700*	ND(<0.01)	0.0010	0.1	0.044	4	16	0.044
Endosulfan I	8,168*	0.1	0.009	0.9	N/A	N/A	16	0.9
Endosulfan II	8,031*	0.1	0.009	0.9	N/A	N/A	16	0.9
Endosulfan Sulfate	10,038*	0.1	0.01	1.0	N/A	N/A	16	1.0
Endrin	9,157*	ND(<0.01)	0.001	0.1	N/A	20	8	0.10
Endrin keytone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
gamma - BHC (Lindane)	1,080	ND(<0.05)	0.0006	0.06	5.4	20	8	0.06
gamma - chlordane	140,000	0.1	0.14	14.0	0.54	5	80	0.54
Heptachlor	12,000	ND(<0.01)	0.0010	0.1	0.16	40	8	0.10
Heptachlor epoxide	220	ND(<0.01)	0.0002	0.02	0.077	0.8	8	0.02
Methoxychlor	25,637	35.0	9.0	900	N/A	400	80	***
Mitotane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Parathion	760	1.5	0.012	1.2	N/A	500	8	1.2
PCBs	17,510*	0.1	0.1	10.0	1.0	N/A	160	1.0(Surface 10(sub-surf
Polychlorinated dibenzo-furans(PCDF)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Silvex	2,600	0.26	0.007	0.7	N/A	600	330	0.7
2,4,5-T	53	35	0.019	1.9	N/A	200	330	1.9

a. Allowable Soil Concentration Cs = f x Cw x Koc

b. Soil cleanup objective = Cs x Correction Factor (CF)

N/A is not available

* Partition coefficient is calculated by using the following equation: log Koc = -0.55 log S + 3.64, where S is solubility in water in ppm. All other Koc values are experimental values.

** Correction Factor (CF) of 100 is used as per TAGM #4046

*** As per TAGM #4046, Total Pesticides < 10 ppm.

Note: Soil cleanup objectives are developed for soil organic carbon content (f) of 1% (5% for PCBs as per PCB guidance document), and should be adjusted for the actual soil organic Carbon content if it is known.

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TABLE 4

Recommended Soil Cleanup Objectives (mg/kg or ppm) for Heavy Metals

Contaminants	Protect Water Quality ppm	Eastern USA Background ppm	* CRDL mg/kg or ppm	***** Rec.soil Clnup Objct. (ppm)
Aluminum	N/A	33,000	2.0	SB
Antimony	N/A	N/A	0.6	SB
Arsenic	N/A	3-12 **	0.1	7.5 or SB
Barium	N/A	15-600	2.0	300 or SB
Beryllium	N/A	0-1.75	0.05	0.16(HEAST) or SB
Cadmium	N/A	0.1-1	0.05	1 or SB
Calcium	N/A	130 - 35,000 **	50.0	SB
Chromium	N/A	1.5-40 **	0.1	10 or SB
Cobalt	N/A	2.5-60 **	0.5	30 or SB
Copper	N/A	1-50	0.25	25 or SB
Cyanide	N/A	N/A	0.1	***
Iron	N/A	2,000 - 550,000	1.0	2,000 or SB
Lead	N/A	****	0.03	SB****
Magnesium	N/A	100 - 5,000	50.0	SB
Manganese	N/A	50 - 5,000	0.15	SB
Mercury	N/A	0.001-0.2	0.002	0.1
Nickel	N/A	0.5-25	0.4	13 or SB
Potassium	N/A	8,500 - 43,000 **	50.0	SB
Selenium	N/A	0.1-3.9	0.05	2 or SB
Silver	N/A	N/A	0.1	SB
Sodium	N/A	6,000 - 8,000	50.0	SB
Thallium	N/A	N/A	0.1	SB
Vanadium	N/A	1-300	0.5	150 or SB
Zinc	N/A	9-50	0.2	20 or SB

Note: Some forms of metal salts such as Aluminum Phosphide, Calcium Cyanide, Potassium Cyanide, Copper cyanide, Silver cyanide, Sodium cyanide, Zinc phosphide, Thallium salts, Vanadium pentoxide, and Chromium (VI) compounds are more toxic in nature. Please refer to the USEPA HEASTs database to find cleanup objectives if such metal salts are present in soil.

SB is site background
N/A is not available

* CRDL is contract required detection limit which is approx. 10 times the CRDL for water.

** New York State backgrond

*** Some forms of Cyanide are complex and very stable while other forms are pH dependent and hence are very unstable. Site-specific form(s) of Cyanide should be taken into consideration when establishing soil cleanup objective.

**** Background levels for lead vary widely. Average levels in undeveloped, rural areas may range from 4-61 ppm. Average background levels in metropolitan or suburban areas or near highways are much higher and typically range from 200-500 ppm.

*****Recommended soil cleanup objectives are average background concentrations as reported in a 1984 survey of reference material by E. Carol McGovern, NYSDEC.

TOTAL ORGANIC CARBON (TOC)

USE AND LIMITATIONS

Total organic carbon is a measure of the total amount of nonvolatile, volatile, partially volatile, and particulate organic compounds in a sample. Total organic carbon is independent of the oxidation state of the organic compounds and is not a measure of the organically bound and inorganic elements that can contribute to the biochemical and chemical oxygen demand tests.

Because inorganic carbon (e.g., carbonates, bicarbonates, free CO_2) will interfere with total organic carbon determinations, samples should be treated to remove inorganic carbon before being analyzed.

FIELD PROCEDURES

Collection

Samples can be collected in glass or plastic containers. A minimum sample size of 25 g is recommended. If unrepresentative material is to be removed from the sample, it should be removed in the field under the supervision of the chief scientist and noted on the field log sheet.

Processing

Samples should be stored frozen and can be held for up to 6 mo under that condition. Excessive temperatures should not be used to thaw samples.

LABORATORY PROCEDURES

Analytical Procedures

- Equipment
  - Induction furnace
    - e.g., Leco WR-12, Dohrmann DC-50, Coleman CH analyzer, Perkin Elmer 240 elemental analyzer, Carlo-Erba 1106
  - Analytical balance
    - 0.1 mg accuracy
  - Desiccator
  - Combustion boats
  - 10 percent hydrochloric acid (HCl)
  - Cupric oxide fines (or equivalent material)
  - Benzoic acid or other carbon source as a standard.

- Equipment preparation
  - Clean combustion boats by placing them in the induction furnace at 950° C. After being cleaned, combustion boats should not be touched with bare hands.
  - Cool boats to room temperature in a desiccator.
  - Weigh each boat to the nearest 0.1 mg.

- Sample preparation
  - Allow frozen samples to warm to room temperature.
  - Homogenize each sample mechanically, incorporating any overlying water.
  - Transfer a representative aliquot (5-10 g) to a clean container.

- Analytical procedures
  - Dry samples to constant weight at 70 ± 2° C. The drying temperature is relatively low to minimize loss of volatile organic compounds.
  - Cool dried samples to room temperature in a desiccator.
  - Grind sample using a mortar and pestle to break up aggregates.
  - Transfer a representative aliquot (0.2-0.5 g) to a clean, preweighed combustion boat.
  - Determine sample weight to the nearest 0.1 mg.
  - Add several drops of HCl to the dried sample to remove carbonates. Wait until the effervescing is completed and add more acid. Continue this process until the incremental addition of acid causes no further effervescence. Do not add too much acid at one time as this may cause loss of sample due to frothing. Exposure of small samples (i.e., 1-10 mg) having less than 50 percent carbonate to an HCl atmosphere for 24-48 h has been shown to be an effective means of removing carbonates (Hedges and Stern 1984). If this method is used for sample sizes greater than 10 mg, its effectiveness should be demonstrated by the user.
  - Dry the HCl-treated sample to constant weight at 70 ± 2° C.
  - Cool to room temperature in a desiccator.
  - Add previously ashed cupric oxide fines or equivalent material (e.g., alumina oxide) to the sample in the combustion boat.
  - Combust the sample in an induction furnace at a minimum temperature of 950 ± 10° C.

- Calculations
  - If an ascarite-filled tube is used to capture CO_2, the carbon content of the sample can be calculated as follows:

$$\text{Percent carbon} = \frac{A(0.2729)(100)}{B}$$

Where:

A = the weight (g) of CO_2 determined by weighing the ascarite tube before and after combustion

B = dry weight (g) of the unacidified sample in the combustion boat

0.2729 = the ratio of the molecular weight of carbon to the molecular weight of carbon dioxide

A silica gel trap should be placed before the ascarite tube to catch any moisture driven off during sample combustion. Additional silica gel should be placed at the exit end of the ascarite tube to trap any water that might be formed by reaction of the trapped CO_2 with the NaOH in the ascarite.

- If an elemental analyzer is used, the amount of CO_2 will be measured by a thermal conductivity detector. The instrument should be calibrated daily using an empty boat blank as the zero point and at least two standards. Standards should bracket the expected range of carbon concentrations in the samples.

QA/QC Procedures

It is critical that each sample be thoroughly homogenized in the laboratory before a subsample is taken for analysis. Laboratory homogenization should be conducted even if samples were homogenized in the field.

Dried samples should be cooled in a desiccator and held there until they are weighed. If a desiccator is not used, the sediment will accumulate ambient moisture and the sample weight will be overestimated. A color-indicating desiccant is recommended so that spent desiccant can be detected easily. Also, the seal on the desiccator should be checked periodically and, if necessary, the ground glass rims should be greased or the "O" rings should be replaced.

It is recommended that triplicate analyses be conducted on one of every 20 samples, or on one sample per batch if less than 20 samples are analyzed. A method blank should be analyzed at the same frequency as the triplicate analyses. The analytical balance should be inspected daily and calibrated at least once per week. The carbon analyzer should be calibrated daily with freshly prepared standards. A standard reference material should be analyzed at least once for each major survey.

DATA REPORTING REQUIREMENTS

Total organic carbon should be reported as a percentage of the dry weight of the unacidified sample to the nearest 0.1 unit. The laboratory should report the results of all samples (including QA replicates, method blanks, and standard reference measurements) and should note any problems that may have influenced sample quality. The laboratory should also provide a summary of the calibration procedure and results (e.g., range covered, regression equation, coefficient of determination).

Spill
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Series

STARS Memo #1

Petroleum-Contaminated Soil Guidance Policy

Prepared by:
New York State Department of Environmental Conservation
Division of Construction Management
Bureau of Spill Prevention and Response

August 1992

NEW YORK STATE PETROLEUM-CONTAMINATED SOIL GUIDANCE

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New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233 - 3510

Thomas C. Jorling
Commissioner

October 26, 1992

Dear Sir/Madam:

Enclosed is the New York State Department of Environmental Conservation's (NYSDEC) Petroleum Soil Guidance Policy. This signed version supersedes all previous drafts.

This guidance document describes both proper soil management practices and cleanup criteria which may allow non-hazardous petroleum contaminated soil to be beneficially reused. The clean-up criteria can be used to develop remediation plans at petroleum spill sites and, although the document addresses excavated material, the methodologies and clean-up levels can be used as a guide when remediating in-situ material.

If additional copies of the guidance are needed please call 518/457-3891. If you have general questions concerning the contents of the document please call 518/457-2462. Questions relating to specific remediation sites should be directed to the NYSDEC regional office oil spill unit.

Sincerely,

Robert G. Hampston, P.E., Director
Division of Spill Prevention,
Response and Remediation

Enclosure

Table of Contents (Cont'd)

SECTION I
PURPOSE AND APPLICABILITY

The goal at each petroleum spill site is to remove the spilled petroleum product from the soil in the most efficient and safe manner in order that the soil may be returned to a reusable product. When complete removal is not possible, practical, or cost effective, the objective is to remediate the contaminated media to concentration levels which will protect groundwater, human health and the environment.

The Petroleum-Contaminated Soil Guidance Policy is intended to provide direction on the handling, disposal and/or reuse of non-hazardous petroleum-contaminated soils. The reuse or disposal options for excavated soils vary depending on the level of treatment provided consistent with protecting the public health and the environment. While this document does not establish standards, it is intended as guidance in determining whether soils have been contaminated to levels which require investigation and remediation.

This document also constitutes a determination of beneficial use by the Department, as defined in Solid Waste Regulation NYCRR Part 360. Petroleum-contaminated soil, if determined to satisfy the criteria herein, can be reused or disposed of as directed in this guidance. Therefore, soils which meet beneficial use conditions are no longer a solid waste in accordance with NYCRR Part 360-1.2(a)(4).

This guidance is intended for Regional Spill Investigators, Regional Solid Waste staff and responsible parties to assist them in determining the acceptability of remedial activities at a petroleum spill site or in determining the acceptability of a site assessment. It may be applied to both excavated and non-excavated material. The evaluation method and guidance values included in this guidance may be used to determine the limits of contamination, such as defining the extent of contamination in an excavation which contains contaminated material. Situations may exist where results of sampling analysis will require interpretations or subjective judgement, as with certain nuisance characteristics such as odors. These interpretations and judgements will be made solely by the DEC representative on site. There may be instances where the DEC will opt to digress from this guidance to establish cleanup goals reflecting site-specific circumstances at a particular petroleum spill site.

The guidance may also be used by responsible parties to develop corrective action plans which will achieve the criteria set forth in this document.

Robert G. Hampston
Director
Division of Construction Management

Norman H. Nosenchuck
Director
Division of Solid Waste

SECTION II

HAZARDOUS WASTE DETERMINATION

An initial determination[1] must be made on all excavated petroleum-contaminated soil as to whether or not it is a hazardous waste. The hazardous waste determination typically involves laboratory analysis to quantify contaminant concentrations in the waste material. The DEC and EPA regulations, however, allow the generator of the waste to use knowledge of the waste and/or laboratory analysis to make a hazardous waste determination. Petroleum-contaminated soils are generally stored on site while laboratory analysis results are obtained and evaluated. As long as the material is segregated from the environment by impervious material, such as polyethylene sheeting, the petroleum-contaminated soil may remain on site until appropriate laboratory results are available and interpreted.

A petroleum-contaminated soil is considered a characteristic hazardous waste when it exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity, as defined in 6NYCRR Part 371, Section 371.3, or 40 CFR Section 261. Knowledge of soils contaminated with virgin petroleum products indicates that those waste materials do not demonstrate ignitability, corrosivity, or reactivity characteristics. Therefore, the only characteristic of concern for virgin petroleum-contaminated soil is toxicity. The Toxicity Characteristic (TC) Rule identifies benzene and lead as compounds which may cause petroleum-contaminated waste to be hazardous. Analysis of additional parameters may be necessary for petroleum-contaminated soil located at sites where other contaminants may be present. Refer to Appendix A for more specific information regarding the procedures for hazardous waste determination, and the TC Rule regulatory levels.

If the contaminated soil has been excavated and if the hazardous waste criteria apply, then the contaminated soil is classified as a hazardous waste. Excavated soil which is hazardous due to any non-petroleum component will be referred to the Division of Hazardous Waste Remediation, and the Division of Hazardous Substances Regulation to determine appropriate remedial actions.

If in-situ soil is contaminated by a petroleum product, and if the above hazardous waste criteria are met, the site will be remediated under the direction of the Bureau of Spill Prevention and Response to provide for protection of human health and environmental quality. In-situ soil, which violates any of the hazardous waste criteria due to any non-petroleum component, will be referred to the Division of Hazardous Waste Remediation, and the Division of Hazardous Substances Regulation to determine appropriate remedial actions.

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[1] In-situ or excavated soils which could contain contaminants other than petroleum products, by virtue of laboratory analysis, site history, visual observations, etc., will be sampled and analyzed by either the responsible party or by the Bureau of Spill Prevention and Response (BSPR). The Division of Hazardous Substances Regulation (DHSR) will provide assistance to BSPR staff (for state-funded projects) and responsible parties in making hazardous waste determinations for their generated waste.

SECTION III

SOIL CLEANUP GUIDELINES

There are four essential guidelines which must be satisfied in order for soil to be considered acceptably remediated or not sufficiently contaminated. These are: A) protection of the groundwater; B) protection of human health; C) protection of fish and wildlife and the environment in which they live; and D) protection against objectionable nuisance characteristics. Compliance with these guidelines is satisfied by analysis of soil samples for contaminant concentrations and leachability, and subsequent comparison of the sampling results to guidance values, values which have been determined to be acceptable by DEC.

Contaminant concentrations are determined using EPA standard Methods 8021 or 8270. Leachability is determined using a procedure known as the Toxicity Characteristic Leaching Procedure (TCLP). Satisfactory protection of groundwater is indicated by TCLP Extraction Guidance Values or by TCLP Alternative Guidance Values. Satisfactory protection of human health is indicated by Human Health Guidance Values. Satisfactory protection of water body sediment is indicated by Sediment Guidance Values. Finally, satisfactory protection against objectionable nuisance characteristics is indicated by the lack of odor and by each contaminant concentration being less than 10,000 ppb. Tables 1 and 2 in Section VIII list the contaminants of concern and their corresponding guidance values for acceptable soil concentrations for components of gasoline and fuel oil, respectively. Analysis of additional parameters may be necessary for petroleum-contaminated soil located at sites where other contaminants may be present.

The procedures used when evaluating soil samples to satisfy these guidelines are discussed further in this section.

A. Protection of Groundwater

The presence of a contaminant in the soil does not determine its potential for groundwater contamination. Soil particles can adsorb contaminants which will not be released through infiltration and groundwater recharge mechanisms. Therefore, it is the leachability of the soil which must be measured. To be protective of groundwater quality, the soil must not leach contaminants to the groundwater at concentrations which violate groundwater standards. The Toxicity Characteristic Leaching Procedure (TCLP) has been accepted by the Department[2] as a method of determining leachability of petroleum-contaminated soil.

The Toxicity Characteristic Leaching Procedure (TCLP) is an extraction process designed to address the leaching potential of organic and inorganic contaminants. It is used to simulate the actual site-specific leaching potential of individual contaminants present in the soil. In the extraction process, the soil sample is mixed with an acid solution and shaken for

[2] Accepted by NYSDEC Cleanup Standards Task Force.

approximately eighteen hours. For non-volatile organic and inorganic compounds, the soil/acid solution is filtered to produce an extract liquid. For volatile organic compounds, the soil/acid solution is held in a Zero Headspace Extractor (ZHE), preventing the escape of volatile organics, and a liquid extract is squeezed out of the soil/acid solution. The extracted liquid is then analyzed to determine the concentration of the petroleum compounds in question. If the concentrations in the extract are less than or equal to the groundwater standards, then the soil may be considered environmentally acceptable for groundwater protection. Tables 1 and 2 in Appendix B identify the TCLP Extraction Guidance Values for the primary components of gasoline and fuel oil. The tabulated TCLP Extraction Guidance Values are equal to the NYSDEC groundwater standards or the NYSDOH drinking water standards, whichever is more stringent.

An alternative approach to the actual extraction process of the TCLP laboratory procedure which may be a cost-saving shortcut is to evaluate the concentration of the contaminant in the soil and mathematically determine if it will satisfy the leachate criteria. The TCLP laboratory procedure requires the soil sample to be diluted by a ratio of 20:1 when preparing the sample for the acidic extraction, and subsequent leachate analysis. Assuming that the entire mass of the contaminants present in the soil will leach out during the extraction process, the dilution factor of 20 can be applied to the actual soil contaminant concentration to give a maximum possible contaminant concentration obtainable in the leachate.

If a contaminant concentration in the soil is known, then the maximum possible contaminant concentration in the TCLP extract can be determined by the following equation:

$$\left[\begin{array}{c}\text{Contaminant}\\ \text{Concentration}\\ \text{in Soil}\\ \text{(ug/kg or ppb)}\end{array}\right] \div 20 = \left[\begin{array}{c}\text{Maximum Possible}\\ \text{Contaminant}\\ \text{Concentration}\\ \text{in Extract}\\ \text{Liquid (ug/l or ppb)}\end{array}\right]$$

If the maximum possible contaminant concentration in the extract liquid, as determined by the above equation, is less than or equal to the contaminant's TCLP Extraction Guidance Value, then the contaminant satisfies the groundwater quality protection criterion. If the calculated maximum possible contaminant concentration in the extract liquid is greater than the TCLP Extraction Guidance Value, then no conclusion can be drawn and groundwater quality protection must be confirmed by actually performing the TCLP extraction for that contaminant.

Example:

If the total concentration of Toluene in the soil as determined by

Method 8021 is 100 ug/kg or 100 ppb for Sample A and 140 ug/kg or 140 ppb for Sample B, and the groundwater standard is 5 ppb then:

Sample A is: 100 ug/kg ÷ 20 = 5 ug/l = 5 ppb
Sample B is: 140 ug/kg ÷ 20 = 7 ug/l > 5 ppb

Sample A is considered to have satisfied groundwater protection by the TCLP extraction test for Toluene at 5 ppb. In Sample B, the calculated extract value is greater than 5 ug/l, therefore, no conclusion can be drawn from the calculation, and an actual TCLP extraction test must be performed.

To simplify this alternative approach, TCLP Alternative Guidance Values, which are equal to 20 times the TCLP Extraction Guidance Values, have been included in Tables 1 and 2. Therefore, if a contaminant's soil concentration is known, it can simply be compared to the TCLP Alternative Guidance Values.

The above methodology can also be used to make the hazardous waste determination, with the soil or sediment concentration compared to the respective hazardous waste limit for the leachate. A considerable decrease in analytical costs may be realized if the above equation is used to evaluate contaminant concentration acceptability.

In summary, if the contaminant concentrations in the soil are less than or equal to the TCLP Alternative Guidance Values, <u>or</u> if the contaminant concentrations in the soil extract are less than or equal to the TCLP Extraction Guidance Values, then the soil <u>is</u> considered environmentally acceptable for groundwater quality protection.

B. Protection of Human Health

Protection of human health is an essential requirement of both treatment and reuse of petroleum-contaminated soil. EPA has published health-based standards for many contaminants in soil. The standards are contained in the Health Effects Assessment Summary Table (HEAST REPORT). These standards were derived from methodologies based on soil ingestion values for carcinogens and systemic toxicants.

The appropriate health-based soil Guidance Values are listed in Tables 1 and 2 for the primary components of gasoline and fuel oil.

If the contaminant concentrations in the soil are less than or equal to the Human Health Guidance Values, then the soil is considered safe for human health concerns.

C. Protection of Fish and Wildlife

Protection of fish and wildlife must be satisfied when dealing with contaminated sediment. Some Sediment Guidance Values for protection of aquatic life and animals which consume aquatic life, have been developed and are noted in Tables 1 and 2. Where sediments are contaminated, these Guidance Values should be used. The appropriate natural resource division (eg. Marine, Fish & Wildlife, etc.) should be contacted for situations involving sediment contaminants which do not have tabulated Sediment Guidance Values. If a spill has occurred at a location that may be sensitive to wildlife (eg. wetlands), the Division of Fish and Wildlife should be consulted to determine whether the soil cleanup levels are adequate for natural resource protection.

If the contaminant concentrations in the sediment are less than or equal to the tabulated Sediment Guidance Values, then the sediment is considered environmentally acceptable for fish and wildlife concerns.

D. Protection Against Objectionable Nuisance Characteristics

Petroleum-contaminated soil must not exhibit objectionable nuisance characteristics to be eligible for some reuse options described later in this guidance and listed in Table 3.

1) <u>Petroleum-Type Odors</u>

The soil must not exhibit any discernible petroleum-type odors in order to be considered for the reuse options identified later in this guidance. Odor determinations for state-funded spill projects will be made by the Regional Spill Investigator. Odor determinations for responsible party (RP) sites are the responsibility of the RP. The Regional Spill Investigator may or may not be available to assess the odor criteria at all sites. When the Regional Spill Investigator is on-site, he/she may override the decision of the RP if, in the investigator's opinion, sufficient odors still persist. Determinations by DEC Spill Investigators do not relinquish a responsible party's responsibilities or liabilities under the law.

2) <u>Contaminant Concentrations</u>

The soil shall not contain any contaminant at a concentration above **10,000 ug/kg (10,000 ppb)**. This maximum individual contaminant concentration should support the above odor determination, since some petroleum constituents will not leach at high concentrations but may exhibit odors.

If the soil does not exhibit petroleum-type odors <u>and</u> does not contain any individual contaminant at greater than 10,000 ppb, then the soil is considered acceptable for nuisance characteristics.

SECTION IV

GUIDANCE VALUES

A. Gasoline-Contaminated Soils

Table 1 lists the primary gasoline components of concern. The table identifies the compound names, the preferred EPA laboratory methods for determining contaminant concentration, the detection limits for a liquid matrix (water), the detection limits for a solid matrix (soil), the TCLP Extraction Guidance Values (C_w), the TCLP Alternative Guidance Values (C_a), the Human Health Guidance Values (C_h), and the Sediment Guidance Values (C_s).

Although EPA Method 8021 is preferred, other laboratory methods may be used with prior approval from the DEC Regional Spill Investigator. Other proposed methods should be evaluated on their ability to quantify the compounds of concern at acceptable detection levels.

The tabulated detection limits are the practical quantitation limits (PQLs). The PQL is the lowest level that can be measured within specified limits of precision during routine laboratory operations on most matrices. Efforts should be made to obtain the best detection possible when selecting a laboratory.

To demonstrate groundwater quality protection via the TCLP Extraction Method, the concentration of the hydrocarbon compound in the TCLP extract, as determined by EPA Method 8021 for a liquid matrix, must be less than or equal to the TCLP Extraction Guidance Value, C_w.

-or-

To demonstrate groundwater quality protection via the TCLP Alternative Method, the concentration of the hydrocarbon compound in the soil, as determined by EPA Method 8021 for a solid matrix, must be less than or equal to the TCLP Alternative Guidance Value, C_a.

To demonstrate human health protection, the concentration of the hydrocarbon compound in the soil, as determined by EPA Method 8021 for a solid matrix, must be less than or equal to the Human Health Guidance Value, C_h.

To demonstrate fish and wildlife protection, the concentration of the hydrocarbon compound in the soil, as determined by EPA Method 8021 for a solid matrix, must be less than or equal to the Sediment Guidance Value C_s. Meeting this requirement is only necessary when dealing with contaminated sediment.

To demonstrate nuisance protection, the soil must not exhibit petroleum-type odors, and must not contain any contaminant at greater than 10,000 ppb, as determined by EPA Method 8021 for a solid matrix.

When the Guidance Value or standard is below the detection limit, achieving the detection limit will be considered acceptable for meeting the Guidance Value or standard, as long as the reported laboratory detection limits are reasonably close to the listed PQLs.

B. Fuel Oil-Contaminated Soil

Table 2 lists the primary fuel oil components of concern. As with Table 1, Table 2 identifies compound names, preferred EPA laboratory methods, detection limits, and Guidance Values.

Although EPA Methods 8021 and 8270 are preferred for identifying compounds of concern for gasoline and fuel oil, other laboratory methods may be used with prior approval from the DEC Regional Spill Investigator. Other proposed methods should be evaluated on their ability to quantify the compounds of interest at acceptable detection levels.

Since there is no single laboratory method which will analyze for all of the volatile and semi-volatile compounds of concern, it is generally necessary to use more than one laboratory method for fuel oil analysis. Both volatile and semi-volatile compounds must be addressed initially, but a reduced list of analytes may be acceptable for subsequent sampling depending upon the initial results.

As with Table 1, the detection limits in Table 2 are PQLs. Efforts should be made to obtain the best detection possible when selecting a laboratory.

Experience has shown that soil containing some of the insoluble semi-volatile compounds at high concentrations can exhibit a distinct odor even though the substances will not leach from the soil. Therefore, the maximum individual contaminant concentration of 10,000 ppb is instituted to help address this problem. In addition, anytime a soil exhibits discernible petroleum odors, even if it has met the numerical criteria, it shall not be considered clean enough for some reuse options under 6NYCRR Part 360, as described later in this document.

Odor determination is subjective. Since there is no recognized odor measuring device, some discrepancies may arise between responsible parties and the DEC on this subject. In order to document odor determinations and to address the need for remediation due to odors, the following approaches may be considered: (1) direct the laboratory to identify and quantify all pollutants present in the soil and/or leachate samples instead of just the method's target compounds; and (2) establish site-specific conditions based on an evaluation of the characteristics of the site. The determination and evaluation of odors remains a subject requiring further research and policy development.

Some of the semi-volatiles are carcinogens, and subsequently have groundwater quality Guidance Values of 0.002 ppb. The TCLP Extraction Guidance Values are 0.002 ppb, and the TCLP Alternative Guidance Values are 0.04 ppb. The solid matrix detection limit does not approach this low value. Therefore, when these compounds are determined to be present, the TCLP Extraction Method and the Alternative Guidance Values must be satisfied to demonstrate groundwater quality protection for these particular contaminants. The following compounds listed in Table 2 are affected by this limitation: benzo(a)anthracene; benzo(b)fluoranthene; benzo(k)fluoranthene; benzo(a)pyrene; chrysene; benzo(ghi)perylene; and indeno(1,2,3-cd)pyrene.

Particular attention should be paid to the Human Health Guidance Values for fuel oil-contaminated soil. While the majority of the semi-volatiles have health Guidance Values considerably higher than the contaminant concentration generally encountered at spill sites, there are seven compounds listed in Table 2 which have Human Health Guidance Values lower than the detection limits. When any of these compounds (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene and dibenz(a,h)anthracene) are present, the Human Health Guidance Value most likely will be the limiting factor for achieving acceptable cleanup levels.

To demonstrate **groundwater quality protection via the TCLP Extraction Method**, the concentrations of the hydrocarbon compounds in the TCLP extract, as determined by EPA Methods 8021 and 8270 Base/Neutral for a liquid matrix, must be less than or equal to the TCLP Extraction Guidance Value, C_w;

-or-

To demonstrate **groundwater quality protection via the TCLP Alternative Method**, the concentrations of the hydrocarbon compounds in the soil, as determined by EPA Methods 8021 and 8270 Base/Neutral for a solid matrix, must be less than or equal to the TCLP Alternative Guidance Value, C_a. As described above, the TCLP Alternative Method is not a sufficient demonstration of groundwater protection for some contaminants.

To demonstrate **human health protection**, the concentrations of the hydrocarbon compounds in the soil, as determined by EPA Methods 8021 and 8270 Base/Neutral for a solid matrix, must be less than or equal to the Human Health Guidance Value, C_h.

To demonstrate **fish and wildlife protection**, the concentrations of the hydrocarbon compounds in the soil, as determined by EPA Methods 8021 and 8270 Base/Neutral for a solid matrix, must be less than or equal to the Sediment Guidance Value, C_s. Meeting this requirement is only necessary when dealing with contaminated sediment.

To demonstrate nuisance protection, the soil must not exhibit petroleum-type odors, and must not contain any contaminant at greater than 10,000 ppb, as determined by EPA Methods 8021 and 8270 Base/Neutral for a solid matrix.

When the Guidance Value or standard is below the detection limit, achieving the detection limit will be considered acceptable for meeting the Guidance Value or standard, as long as the reported laboratory detection limits are reasonably close to the listed PQLs.

SECTION V

LABORATORY ANALYSIS

There are a variety of laboratory methods, established by the USEPA and the NYS Department of Health (DOH), which can be used to analyze petroleum-contaminated soils. The selection of appropriate laboratory methods depends on the compounds of concern, the detection limits for each compound, the nature of the samples to be analyzed, the capabilities of the laboratory, and the regulatory limits or Guidance Values to be achieved. The methods recommended and most often used for petroleum-contaminated soils are EPA Standard Methods 8021, 8270 (Base/Neutrals) and the TCLP extraction process. In every case, the NYSDEC will evaluate laboratory results from NYSDOH-approved laboratories only.

Each laboratory method identifies compounds which can be quantified with an acceptable degree of precision and accuracy. Many laboratory methods have petroleum compounds as target compounds, along with non-petroleum compounds. Method 8270, for example, identifies acid extractable hydrocarbons and base/neutral extractable hydrocarbons. The semi-volatile constituents of petroleum products are a sub-set of the base/neutral extractable compounds under Method 8270. Therefore, when requesting this analysis, base/neutrals only should be specified.

Some laboratories may be able to quantify non-target compounds of concern with particular methods. For example, there is no laboratory method which lists MTBE (methyl t-butyl ether) as a target compound; however, laboratories can include MTBE in their analysis using Method 8021. Therefore, when requesting this analysis, Method 8021 plus MTBE should be specified.

Each laboratory method establishes minimum concentrations of the target compounds which can be detected under ideal conditions using that particular procedure. These Method Detection Limits (MDLs) are rarely achievable under actual conditions in an analytical laboratory. Laboratories report their actual detection limits as Practical Quantitation Limits (PQLs). The PQLs for analysis on a liquid matrix are generally four times the MDLs. With a solid matrix, the PQLs will be affected by the quantity of contamination present, categorized as low, medium or high concentrations. Lower PQLs are generally possible with low level soil contamination. Laboratories must identify their PQLs when reporting analytical results.

Laboratories and methods to be utilized should be selected according to the best detection possible for the compounds of interest, and the regulatory or guidance levels needed to be achieved. For example, Table 2 indicates that naphthalene is a target compound for Method 8021 and Method 8270. Both of these methods can provide detection levels in a liquid matrix below the TCLP Extraction Guidance Value of 10 ppb. Therefore, either method could be used for analysis of a liquid matrix of naphthalene. However, for a solid matrix, Method 8021 is capable of providing much better detection of naphthalene than Method 8270. If the soil concentrations for naphthalene will be compared to the TCLP Alternative Guidance Value of 200 ppb, then Method 8021 should be used instead of Method

8270. If the soil concentrations for naphthalene will be compared only with the nuisance protection level of 10,000 ppb, or the Human Health Guidance Value of 300,000 ppb, then both Method 8021 and Method 8270 are capable of providing satisfactory detection levels for naphthalene.

Initial laboratory analysis should address the full range of compounds which may be present, considering the petroleum products involved. In consideration of prior laboratory results, potential contaminants may be eliminated from subsequent sampling analysis lists. As the contaminants are identified or eliminated, it may be appropriate to change laboratory methods during a project, to avoid unnecessary laboratory expenses. In addition, it may be appropriate to discuss analytical work with the laboratory in terms of the actual compounds of interest rather than method numbers and their defined target compounds. The final laboratory results for a project, however, should address the same full range of compounds as the initial sampling results, to confirm that the interim results did not overlook the appearance of other compounds. For example, gasoline-contaminated soil which is undergoing on-site bioremediation should be analyzed initially using Method 8021 plus MTBE. If only benzene, toluene, ethyl benzene and xylenes are detected, then Method 8020 could be used for interim sampling events. Upon completion of the bioremediation project, the soil should be analyzed using Method 8021 plus MTBE, to demonstrate the satisfaction of the Guidance Values applicable to the selected reuse option.

A detailed description of analytical protocols and procedures is available in the DEC Sampling Guidelines and Protocols manual.

SECTION VI

SAMPLING

Samples should be collected in such a manner so as to best characterize the extent of contamination of the soil in question. There is no specific number or type of samples which will apply to all situations and best engineering judgement will have to be used. The type of sample, grab or composite, will vary depending upon the constituent being identified. While grab samples come from one location, composites come from several locations and are joined to form one sample. When volatiles are in question, care must be taken when collecting composite samples to minimize the loss of volatiles during handling. In order to minimize handling of volatiles, several grab samples are preferred, with confirmatory composite samples. When sampling for semi-volatiles, several composite samples are preferred, with confirmatory grab samples.

The treatment process (if any) will also have a bearing as to how well a soil may be characterized. Low temperature thermal treatment units (e.g. rotary kiln dryers) process soil resulting in a more homogeneous mixture than would be obtained from a stationary pile. The following guidance is offered to assist the Regional Spill Investigator in determining the number and types of samples which should be requested for various treatment scenarios. More comprehensive samples may be required depending on the reuse or disposal alternative to be used.

The responsible party and the Regional Spill Investigator should agree on a sampling plan and review procedure before the samples are collected. All sample results submitted for regulatory compliance must be analyzed by New York State Department of Health approved laboratories.

A detailed description of soil sampling protocols and procedures is available in the DEC Sampling Guidelines and Protocols manual.

A. Tank Pit

If there is a question as to the extent of residual contamination, or if comprehensive documentation is necessary, a tank pit may be sampled for laboratory analysis.

A total of five samples should be taken from the excavation. One composite sample from each of the side walls at a distance approximately one third up from the bottom of the pit. Several samples should also be collected to form one composite sample from the bottom of the pit. Any remaining samples should be grab samples from areas with greater potential for contamination such as stained soils, adjacent to a corrosion hole, opposite a manway, or opposite a tank opening. All samples shall be taken no less than six inches below the exposed surface being sampled. Samples for compositing should be taken from random locations on the floor and walls of the tank pit.

B. Soil Pile

The number of samples required for an excavated pile will be related to the quantity of soil stockpiled. The table below can be used as a guide in determining the appropriate number of samples. If, in the opinion of the Regional Spill Investigator, additional samples are warranted, they should be requested.

Recommended Number of Soil Pile Samples

CONTAMINANT	SEMI-VOLATILES		VOLATILES	
SAMPLE TYPE	Grab	Composite	Grab	Composite
SOIL QUANTITY (yd^3)				
0-50	1	1	1	1
50-100	1	2	2	1
100-200	1	3	3	1
200-300	1	4	4	1
300-400	2	4	4	2
400-500	2	5	5	2
500-800	2	6	6	2
800-1000	2	7	7	2
>1000 - Proposed Sampling plan shall be submitted for approval on site specific basis				

Best engineering judgement is needed to determine the most appropriate sampling locations. The objective of the sampling is to characterize the extent of contamination of the pile. Consideration should be given to how the soil was stockpiled. Is the most contaminated soil toward the top? Are areas visibly contaminated? How high and how long is the pile? It may be preferable to divide the pile into manageable segments. Samples should be taken from within the pile. Surface soil should not be used as sampling material. Samples shall be collected in accordance with proper sample collection techniques. All samples must be collected in glass containers with air-tight sealable tops.

Using the above sampling table, considering the factors mentioned above, and applying best engineering judgement, an acceptable evaluation of the contaminant concentrations in the soil can be made.

C. Processed Soil

Processed soil is soil which undergoes physical handling during a treatment process. Examples of treatment processes are rotary kiln dryers (low temperature thermal treatment units) or soil washing units. Soil under these conditions are more homogeneously mixed; therefore, individual samples are more likely to characterize the entire lot. Since these processes are continuous in nature, the samples should be collected over a period of time similar to that described below:

1) A sample may be collected every twenty minutes for a period of two hours. The samples are then mixed to form one composite sample. This frequency will continue until all soils are processed. The twenty minute composite interval is a guideline which can be adjusted based on the amount of soil processed and the processing period. Testing protocols are specifically defined in the treatment unit's operating permit.

2) At least one grab sample should be taken for every two sets of composites.

3) A minimum of two samples (1 grab, 1 composite) should be taken for any treated soil batch.

D. Aboveground (Ex-Situ) Treatment

Typical aboveground treatment technologies are bioremediation and soil vapor extraction. Soil remediated under these conditions will be mixed (tilled) and spread evenly over a wide area. The soil will be spread to a uniform thickness, usually no higher than two feet, although depths may be higher for soil vapor extraction treatment. The shallow depth makes sample collection an easy process. The number of required samples can be based on the quantity of soil being treated (see above table). Depth of the sample can be anywhere from six inches to the bottom of the treatment layer. Care must be taken not to penetrate the liner material. The sampling locations and depths must be randomized.

E. Non-Excavated (In-Situ) Treatment

Treatment of non-excavated soil is similar to aboveground treatment in that the contamination is spread over a wide area. It differs, however, in that the depths of the contaminated zone are varied and usually extend much deeper. Once the volume of contaminated material is determined, the above table can be used to determine the number of required samples. The sampling locations and depths must be randomized.

SECTION VII

MANAGEMENT OF EXCAVATED (EX-SITU) CONTAMINATED SOILS

Once non-hazardous petroleum-contaminated soil is moved from its original state, it is by definition a solid industrial waste and must be managed in accordance with Part 360 and transported in accordance with Part 364 regulations. There are several alternatives available to properly handle this contaminated soil.

A. Soils Which Do Not Meet Guidance Values

Soils which do not meet the guidance values can be processed under a specific DEC Beneficial Use Determination (BUD), such as at an approved hot-mix asphalt batching plant or at a cold-mix asphalt plant, disposed of at a DEC authorized landfill, or treated on site.

1) Reuse Under Specific Beneficial Use Determinations

The DEC Division of Solid Waste has made Beneficial Use Determinations (BUD's) under 6 NYCRR Part 360, identifying recycling or re-use activities which are not subject to Part 360 regulations. The use of petroleum-contaminated soil in a manufacturing process to produce a marketable product may be eligible for BUD issuance. Each manufacturing process operator must maintain compliance with the specific requirements of the issued BUD. Hot-mix and cold-mix asphalt manufacturing are two examples of processes which have received BUD's, and other processes may be approved by the Division of Solid Waste in the future.

a. Reuse at an Approved Asphalt Batching Plant

Several asphalt plants have been authorized to accept non-hazardous contaminated soil, for use as aggregate, provided the plant is in compliance with any other DEC regulations which may apply to the facility. For example, the use of petroleum-contaminated soil may require a modification of the facility's air emission permit.

b. Production of Cold-Mix Asphalt

A Beneficial Use Determination (BUD) has been issued to the process which combines liquid asphalt emulsion with the contaminated soil to produce a cold-mix asphalt. Approval to process petroleum-contaminated soil to produce a cold-mix asphalt is issued by the Spill Response Program. The applicant must satisfy specific testing requirements prior to receiving approval to process. Each BUD identifies allowable uses for the manufactured cold-mix asphalt and any qualifying conditions and post-treatment testing protocols.

These asphalt products, if being stockpiled or transported for disposal rather than reuse, no longer meet the requirements for these BUDs and are subject to all applicable regulatory provisions of 6NYCRR Parts 360 and 364.

PCS containing asphalt products, which are left in a stockpile and are not being beneficially used, remain a solid waste until such use is accomplished. These materials shall be removed from the stockpile for beneficial use in accordance with their beneficial use approval requirements; or disposal if necessary, as rapidly as possible.

2) Disposal at an Authorized Landfill

A DEC-authorized landfill is one which either has an operating permit or is under a consent order. While this is not the preferred method of dealing with contaminated soil, it may be the most economical or, due to site constraints, the only alternative. Additional restrictions may be required by the landfill operators prior to accepting materials at their facilities.

3) Treatment On Site

Non-hazardous petroleum-contaminated soil may be treated on the site of generation without a DEC Part 360 Permit. Depending on the treatment technologies being utilized, other DEC permits may be required for air emissions and water discharges.The soil treatment processes may involve excavation of soils, securely stockpiling the soils until treatment is initiated, aboveground treatment of the soils, and/or placement of soils back into an excavation for treatment. The Regional Spill Investigator should require a remedial plan, signed by the responsible party, prior to the placement of contaminated soils into an excavation for treatment.

If the soil is to be placed back in an excavation for treatment, and if the excavation is determined to be uncontaminated, the excavation must be prepared and lined in such a manner to protect it against contamination from the soil which will be treated. However, if the excavation is contaminated it shall be the decision of the Regional Spill Investigator as to whether a liner is necessary.

All excavated soil shall be placed on an impervious material (eg: polyethylene sheeting) with the sides banked so as to control and contain run-off. During periods when no treatment is on-going, the surface of the pile(s) must also be covered with an impervious material.

The site may have to be evaluated for its impact to the ambient air. Cross media contamination shall be minimized and aesthetic or nuisance issues shall be addressed. If space on the site is limited, or if the protection of the public health is in jeopardy, then on-site treatment will not be allowed and soil must be removed to a permitted location for treatment or disposal.

There are several methods of on-site soil treatment. Typical among these are soil venting, bioremediation, soil washing and low temperature thermal treatment. All treatment should be evaluated based on its ability to achieve the desired result in the most economical and efficient manner.

B. Soils Which Meet Guidance Values

The reuse options available for de-contaminated soil depends upon which particular Guidance Values are satisfied by the soil. Table 3 identifies the reuse options and the Guidance Values which must be met to use each reuse option.

As described earlier, the DEC Division of Solid Waste (DSW) has issued a Generic Beneficial Use Determination (BUD) which exempts petroleum-contaminated soils, which have been successfully incorporated into an asphalt product by a Bureau of Spill Prevention and Response (BSPR) approved producer and which will be utilized in a bonified paving project.

In addition, the DSW has determined that soils which satisfy the appropriate Guidance Values and which will be reused as highway sub-base material, fill for the original excavation, fill elsewhere on the site of generation, or fill off-site at pre-approved locations, are being beneficially used and are exempt from the provisions of 6NYCRR Part 360. These soils are also exempt from 6NYCRR Part 364 since they no longer meet the Part 364 definition of "solid waste".

The reuse options are not listed as a hierarchy; however, off-site reuse is generally less desirable. The Regional Spill Supervisor or his/her designee will review all appropriate soil sampling data to determine if the criteria has been met for the requested reuse option. Upon request from the responsible party, the evaluation of the submitted data shall be documented with a statement from the Regional Spill Supervisor that the soil does or does not meet the criteria for the desired reuse option. **The DEC and its designee assume no liability when evaluating data for a responsible party with regard to the reuse or disposal of the soil in question.** The generator of the soil has the ultimate responsibility for the accurate and precise characterization, and the safe and proper reuse or disposal of the material. In addition, soil which is being reused off site shall not be allowed to be transported prior to the receipt of the laboratory reports confirming that the soil has satisfied the appropriate Guidance Values of this guidance document. **The responsible party shall maintain all field data, laboratory results, and final disposition records for three years.**

The possible reuse options are presented below. Additional uses of decontaminated petroleum-contaminated soil may be identified in a Part 360 Permit or BUD for a specific facility.

1) Reuse as a Construction Material

Soil which satisfies the Guidance Values for groundwater protection, human health protection and nuisance characteristics can be reused as construction material. Construction material can include hot asphalt, cold-mix asphalt, concrete, roadway sub-base, etc. Final destination of the soil shall be identified prior to removal from the site.

2) Returned to the Original Excavation

Soil which satisfies the Guidance Values for groundwater protection, human health protection, and nuisance characteristics, can be placed back in the hole from which it was excavated.

3) Placed Elsewhere on Site

Soil which satisfies the Guidance Values for groundwater protection, human health protection, and nuisance characteristics, can be placed anywhere within the confines of the contiguously-owned property from which it originated.

4) Reuse Off-Site at a Pre-Approved Location

The Regional Spill Engineer and Regional Solid Waste Engineer may approve a request for an off-site reuse location for remediated soil which satisfies the Guidance Values for groundwater protection, human health protection, and nuisance characteristics. Sites which may be considered for this option are industrial sites, authorized construction and demolition debris landfills, petroleum storage facilities, authorized landfills, or other locations where public access is limited. Written approval must be received from the property owner(s) prior to exercising this reuse option. The responsible party may submit such a request to the Regional Spill Engineer who will coordinate with the Regional Solid Waste Engineer to approve or disapprove the request.

C. Rock Debris

Rock debris, for purposes of this policy, is defined as those rocks which are four (4) inches or greater in diameter. They shall be cleaned of any packed-on petroleum-contaminated soil. These rocks are not treated as a solid waste and can be disposed of as construction and demolition debris.

If rock debris cannot be separated from the petroleum-contaminated soil, it shall be handled as a solid waste in accordance with NYCRR Part 360 and/or Part 364 requirements.

SECTION VIII

MANAGEMENT OF NON-EXCAVATED (IN-SITU) CONTAMINATED SOIL

In-situ contaminated soil may pose a threat to the groundwater, human health and the environment. These sites must be evaluated to determine the extent of contamination and the appropriate investigative or remedial actions necessary. The soil may be treated in-situ and evaluated by the same guidelines as excavated soil, while taking into account site-specific considerations and conditions.

Additional guidance will be developed to establish procedures for evaluating the potential impacts of non-excavated (in-situ) contaminated soils. Issues which should be considered when evaluating in-situ contaminated soil are environmental sensitivity of the site, level of residual contamination, soil characteristics, depth to groundwater, present and potential land use. A proper sampling plan will be necessary to determine the number, quantity and depth of samples to properly characterize the site.

SECTION IX

REFERENCES

NYS Department of Environmental Conservation, Cleanup Standards Task Force, DRAFT Cleanup Policy and Guidelines, October 1991.

NYS Department of Environmental Conservation, Division of Hazardous Substances Regulation, 6NYCRR Part 364, Waste Transporter Permits, January 12, 1990.

NYS Department of Environmental Conservation, Division of Hazardous Substances Regulation, 6NYCRR Part 371 Identification and Listing of Hazardous Wastes, December 25, 1988.

NYS Department of Environmental Conservation, Division of Solid Waste, 6NYCRR Part 360 Solid Waste Management Facilities, May 28, 1991.

NYS Department of Environmental Conservation, Division of Water, Sampling Guidelines and Protocols, March 1991.

NYS Department of Environmental Conservation, Division of Water, Spill Response Guidance Manual, January 1990.

NYS Department of Environmental Conservation, Division of Water, Technical and Operation Guidance Series (1.1.1), Ambient Water Quality Standards and Guidance Values, November 15, 1991.

US Environmental Protection Agency, 40 CFR Part 261 Identification and Listing of Hazardous Wastes, June 29, 1990.

US Environmental Protection Agency, Health Effects Assessment Summary Table, April 4, 1991.

APPENDIX A

HAZARDOUS WASTE DETERMINATION AND REGULATORY LEVELS

In accordance with DEC and EPA regulations, the generator of a waste material must determine if the material is a hazardous waste or a non-hazardous waste. The generator can make this determination using knowledge of the waste and/or laboratory analyses.

A waste material can be a hazardous waste due to its origin, its listed waste content, or its characteristics.

Soil contaminated with virgin petroleum products is a hazardous waste if it exhibits a characteristic of a hazardous waste, namely, ignitability, corrosivity, reactivity, and toxicity. The hazardous waste characteristics, defined in 6NYCRR Part 371, Section 371.3, and 40 CFR Section 261, are described below.

A. Ignitability:

A solid waste exhibits the characteristic of ignitability if a representative sample of the waste has any of the following properties:

1) Is not a liquid and is capable under standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard.

2) It is a liquid, other than an aqueous solution containing less than 24 percent ethyl alcohol by volume, and has a flash point less than 60°C (140°F).

3) It is an ignitable compressed gas.

4) It is an oxidizer.

In accordance with guidance from the DEC Division of Hazardous Substances Regulation and based on knowledge of the waste, soils contaminated with virgin petroleum products do not exhibit the above properties and do not have to be tested for the ignitability characteristic.

B. Corrosivity:

A solid waste exhibits the characteristic of corrosivity if a representative sample of the waste has either of the following properties:

1) It is aqueous and has pH less than or equal to 2 or greater than or equal to 12.5.

2) It is a liquid and corrodes steel at a rate greater than 6.35 mm (0.250 inch) per year at a test temperature of 55°C (130°F).

Based on knowledge of the waste, soils contaminated with virgin petroleum products do not exhibit the above properties, and do not have to be tested for the corrosivity characteristic.

C. Reactivity:

A solid waste exhibits the characteristic of reactivity if a representative sample of the waste has any of the following properties:

1) It is normally unstable and readily undergoes violent change without detonating.

2) It reacts violently with water.

3) It forms potentially explosive mixtures with water.

4) When mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment.

5) It is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors or fumes in quantity sufficient to present a danger to human health or the environment.

6) It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement.

7) It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

8) It is a forbidden explosive, a Class A explosive or a Class B explosive.

Based on knowledge of the waste, soils contaminated with virgin petroleum products do not exhibit the above properties, and do not have to be tested for the reactivity characteristic.

D. Toxicity:

If the Toxicity Characteristic Leaching Procedure (TCLP) extract from a representative sample of the waste contain any of the contaminants identified in the attached listing of Hazardous Waste Regulatory levels at concentrations equal to or greater than the values listed, it is a hazardous waste.

With respect to petroleum-contaminated soil, the primary compound of concern is benzene. If the benzene concentration in a TCLP extract is equal to or greater than 500 ppb, the contaminated material is a characteristic hazardous waste. For gasoline contaminated soil, toxicity for lead must also be evaluated.

The regulatory level of benzene in the soil is determined by analyzing the soil using the TCLP extraction method and determining the concentration in the extract.

A second method of determination is to identify the total concentration of the contaminant in the soil. If the total concentration is less than the regulatory level, then the leachate level could not possibly exceed the standard. This approach would save laboratory costs because the TCLP would not have to be run. If the total concentration in the soil exceeds the regulatory level required in the extract, no conclusion can be drawn from these results and a complete TCLP must be run.

Additional Information on Toxicity Characteristics

On March 29, 1990, the U.S. Environmental Protection Agency established the Toxicity Characteristic (TC) Rule. The TC Rule expands the list of contaminants by which a waste can be classified as hazardous due to toxicity, and it replaces the Extraction Procedure Toxicity (EP Tox) with the Toxicity Characteristic Leaching Procedure (TCLP). The TC Rule's specified contaminant list includes the same 14 metals and pesticides as the original toxicity list, plus 25 additional organic chemicals. Each of the 39 listed contaminants has the potential for rendering a particular material a characteristic hazardous waste due to toxicity. Since benzene is one of the 25 organic compounds added to the toxicity list, and since benzene is commonly found in petroleum products, it is possible that petroleum-contaminated soil may classify as a hazardous waste. Limited relief from these hazardous waste regulations is currently available because the TC Rule has specifically deferred petroleum-contaminated soil, groundwater, and debris generated from underground storage tank (UST) releases, until the impact of the regulation is further evaluated.

UST sites are essentially those sites which have underground storage tanks containing transportation fuels, such as gasoline, jet fuel, aviation gas, and diesel fuel. (See 40 CFR Section 280.12 for a more complete definition). The TC Rule does not apply to petroleum-contaminated media produced by a leak from an UST, including associated underground piping. However, DEC regulations state that the materials contaminated by transportation fuels can be hazardous wastes if they exhibit other hazardous waste characteristics, such as toxicity due to lead.

The TC Rule, as published on March 29, 1990, became effective on September 25, 1990, for large-quantity generators, and March 29, 1991, for small quantity generators. Large quantity generators are defined as those parties who generate 2,200 pounds or more of hazardous waste in any month. Small quantity generators are those parties who generate between 220 and 2,200 pounds of hazardous waste in any month. Until the DEC adopts the TC Rule, waste generators must comply with both the EPA and DEC waste regulations. Refer to the specific regulations of interest for more information.

HAZARDOUS WASTE REGULATORY LEVELS FOR TOXICITY CHARACTERISTIC

CONSTITUENT	REGULATORY LEVEL (mg/L)
Arsenic	5.0
Barium	100.0
Benzene	0.5*
Cadmium	1.0
Carbon tetrachloride	0.5*
Chlordane	0.03*
Chlorobenzene	100.0*
Chloroform	6.0*
Chromium	5.0
o-Cresol	200.0*
m-Cresol	200.0*
Cresol (TOTAL)	200.0*
2,4-D	10.0
1,4-Dichlorobenzene	7.5*
1,2-Dichloroethane	0.5*
1,1-Dichloroethylene	0.7*
2,4-Dinitrotoluene	0.13*
Endrin	0.02
Heptachlor (and its epoxide)	0.008*
Hexachlorobenzene	0.13*
Hexachloro-1,3butadiene	0.5*
Hexachloroethane	3.0*
Lead	5.0
Lindane	0.4
Mercury	0.2

HAZARDOUS WASTE REGULATORY LEVELS FOR TOXICITY CHARACTERISTIC (Cont'd)

CONSTITUENT	REGULATORY LEVEL (mg/L)
Methoxychlor	10.0
Methyl ethyl ketone	200.0*
Nitrobenzene	2.0*
Pentachlorophenol	100.0*
Pyridine	5.0*
Selenium	1.0
Silver	5.0
Tetrachloroethylene	0.7*
Toxaphene	0.5
Trichloroethylene	0.5*
2,4,5-Trichlorophenol	400.0*
2,4,6-Trichlorophenol	2.0*
2,4,5-TP (Silvex)	1.0
Vinyl chloride	0.2*

* New Toxicity Characteristics Effective 9/25/90

TABLE 1
Guidance Values For Gasoline Contaminated Soil*

Compound	EPA Method	Detection Limit[1] (ppb) Liquid	Detection Limit[1] (ppb) Solid	TCLP Extraction Guidance Value[2] C_w (ppb)	TCLP Alternative Guidance Value C_a (ppb)	Human Health Guidance Value C_h (ppb)	Sediment Guidance Value C_s (ppb)
Benzene	8021 (8020)	1	2	0.7	14	2.4×10^4	
Ethylbenzene	8021 (8020)	1	2	5	100	8.0×10^6	
Toluene	8021 (8020)	1	2	5	100	2.0×10^7	
o-Xylene	8021 (8020)	2	2	5	100	2.0×10^8	
m-Xylene	8021 (8020)	2	2	5	100	2.0×10^8	
p-Xylene	8021 (8020)	2	2	5	100	***	
Mixed Xylenes	8021 (8020)	2	2	5	100	2.0×10^8	
Isopropylbenzene	8021	1	1	5	100	***	
n-Propylbenzene	8021	1	1	5	100	***	
p-Isopropyltoluene	8021	1	1	5	100	***	
1,2,4-Trimethylbenzene	8021	1	1	5	100	***	
1,3,5-Trimethylbenzene	8021	1	1	5	100	***	
n-Butylbenzene	8021	1	1	5	100	***	
sec-Butylbenzene	8021	1	1	5	100	***	
Naphthalene	8021	1	1	10	200	3.0×10^5	
Methyl t-butyl ether (MTBE)[3]	8021 (8020)	1	1	50	1,000	***	

*Nuisance Characteristics Guidance:
No petroleum-type odors.
No individual contaminant in soil at greater than 10,000 ppb.

[1] The listed Detection Limits are Practical Quantitation Limits (PQLs). The Method Detection Limit (MDL) is the best possible detection. Laboratories report the Practical Quantitation Limit (PQL), which is generally 4 times the MDL. Efforts should be made to obtain the best detection possible when selecting a laboratory. When the Guidance Value or standard is below the detection limit, achieving the detection limit will be considered acceptable for meeting the Guidance Value or standard.

[2] The TCLP Extraction Guidance Values are equal to the NYSDEC groundwater quality standards or Guidance Values, or the NYSDOH drinking water quality standards or Guidance Values, whichever is more stringent.

[3] Methyl t-butyl ether (MTBE) is not a target compound of Methods 8021 and 8020, but MTBE may be determined using these methods with appropriate quality assurance and quality control measures.

*** No Guidance Value identified in EPA HEAST Report.

TABLE 2
Guidance Values for Fuel Oil Contaminated Soil*

Compound	EPA Method	Detection Limit[1] (ppb)		TCLP Extraction Guidance Value[2] C_w (ppb)	TCLP Alternative Guidance Value C_a (ppb)	Human Health Guidance Value C_h (ppb)	Sediment Guidance Value C_s (ppb)	
		Liquid	Solid				Fresh	Marine
Benzene	8021 (8020)	1	2	0.7	14	2.4×10^4		
Ethylbenzene	8021 (8020)	1	2	5	100	8.0×10^6		
Toluene	8021 (8020)	1	2	5	100	2.0×10^7		
o-Xylene	8021 (8020)	2	2	5	100	2.0×10^8		
m-Xylene	8021 (8020)	2	2	5	100	2.0×10^8		
p-Xylene	8021 (8020)	2	2	5	100	***		
Mixed Xylenes	8021 (8020)	2	2	5	100	2.0×10^8		
Isopropylbenzene	8021	1	1	5	100	***		
n-Propylbenzene	8021	1	1	5	100	***		
p-Isopropyltoluene	8021	1	1	5	100	***		
1,2,4-Trimethylbenzene	8021	1	1	5	100	***		
1,3,5-Trimethylbenzene	8021	1	1	5	100	***		
n-Butylbenzene	8021	1	1	5	100	***		
sec-Butylbenzene	8021	1	1	5	100	***		
t-Butyl benzene	8021	1	1	5	100	***		
Naphthalene[3]	8021 (8270)	1 (6)	1 (330)	10	200	3.0×10^5		
Anthracene	8270	8	330	50	1,000	2.0×10^7		
Fluorene	8270	8	330	50	1,000	3.0×10^6		
Phenanthrene	8270	22	330	50	1,000	***		
Pyrene	8270	8	330	50	1,000	2.0×10^6		
Acenaphthene	8270	8	330	20	400	5.0×10^6		
Benzo(a)anthracene	8270	31	330	.002	.04[4]	220	33	18
Fluoranthene	8270	9	330	50	1,000	3.0×10^6		

(CONTINUED ON THE NEXT PAGE)

TABLE 2 (Cont'd)
Guidance Values for Fuel Oil Contaminated Soil*

Compound	EPA Method	Detection Limit (ppb)		TCLP Extraction Guidance Value[3] C_w (ppb)	TCLP Alternative Guidance Value C_s (ppb)	Human Health Guidance Value C_h (ppb)	Sediment Guidance Value C_s (ppb)	
		Liquid	Solid				Fresh	Marine
Benzo(b)fluoranthene	8270	19	330	.002	.04[4]	220	33	18
Benzo(k)fluoranthene	8270	10	330	.002	.04[4]	220	33	18
Chrysene	8270	10	330	.002	.04[4]	***	33	18
Benzo(a)pyrene	8270	10	330	.002	.04[4]	61	33	18
Benzo(g,h,i)perylene	8270	10	330	.002	.04[4]	***		
Indeno(1,2,3-cd)pyrene	8270	10	330	.002	.04[4]	***		
Dibenz(a,h)anthracene	8270	10	330	50	1,000	14		

* Nuisance Characteristics Guidance:
No Petroleum-type odors.
No individual contaminant in soil at greater than 10,000 ppb.

(1) The listed Detection Limits are Practical Quantitation Limits (PQL's). The Method Detection Limit (MDL) is the best possible detection. Laboratories report the Practical Quantitation Limit (PQL), which is generally 4 times the MDL. Efforts should be made to obtain the best detection possible when selecting a laboratory. When the Guidance Value or standard is below the detection limit, achieving the detection limit will be considered acceptable for meeting the Guidance Value or standard.

(2) The TCLP Extraction Guidance Values are equal to the NYSDEC groundwater quality standards or Guidance Values, or the NYSDOH drinking water quality standards or Guidance Values, whichever is more stringent.

(3) For naphthalene analysis in a liquid matrix, both Method 8021 and Method 8270 can provide satisfactory levels for comparison to the C_w of 10 ppb.

For naphthalene analysis in a solid matrix, Method 8021 is preferred over Method 8270 for comparison to the C_s of 200 ppb. If the C_s Guidance Value is not being used in the soil evaluation, then both Method 8021 and 8270 can provide satisfactory detection levels for comparison to the C_h of 3.0×10^5, and nuisance characteristic of 10,000 ppb.

(4) Due to the high detection limit for a solid matrix, the TCLP Extraction Method must be used to demonstrate groundwater quality protection for these compounds.

*** No Guidance Value identified in EPA HEAST Report.

TABLE 3
Soil Reuse Options

Reuse Option	Minimum Criteria To Be Met[1]		
	Protection of Groundwater	Protection of Human Health	Protection Against Nuisance Characteristics
Asphalt[2] or Concrete Manufacturing			
Cold-Mix Asphalt[2]			
Construction Material	X	X	X
Fill for Original Excavation	X	X	X
Fill Elsewhere On-Site	X	X	X
Off-Site at Pre-Approved Location	X	X	X

(1) In addition, the criteria for protection of fish and wildlife must be met when sediments are the waste materials being handled, and when these soils or sediments are being disposed in surface waters, marine waters, or wetland areas.

(2) The soils must satisfy the criteria established under the particular BUD issuance.